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Significance of Visualization of Gallbladder in Twenty-Four Hour Roentgen Plate

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IN presenting a series of cases of any condition it is always of some interest and value to review briefly the history of the subject, and this is especially applicable to radiologic study of the gallbladder.

In 1897, Buxbaum (Vienna) demonstrated stones in 4 of 30 patients examined. In 1900, Beck in the United States, was able to demonstrate stones in 2 cases. About 1910, Shurmayer and others directed attention to the so-called indirect radiologic signs of cholecystic disease, as follows:

1. Fixation, displacement and/or deformity of the duodenal bulb, pylorus and/or hepatic flexure of the colon, presumed to be due to pericholecystic adhesions.
2. The shadow of the gallbladder produced by abnormal thickness of its walls or the deposit of calcium therein.

In 1922, Dr. Evarts A. Graham had temporarily discontinued the practice of medicine to study chemistry. He was working with the chlorinated phenolphth-

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aleins, and it occurred to him that, since Abel and Rountree had demonstrated that chlorinated phenolphthaleins are excreted almost entirely through the bile, "it might be possible to substitute for the chlorine atom something which would prove opaque to x-ray and therefore cast a shadow of the gallbladder."

He then administered the sodium salt of tetraiodophenolphthalein intravenously to 6 dogs. A shadow of the gallbladder was obtained in only 1 of the 6. Seeking the answer to this, he discovered that the keeper of the dogs had neglected to feed the dog in which visualization occurred, while the other 5 dogs had been given breakfast as usual. "Greater efficiency on the part of the animal keeper," he commented,[1] "would doubtless have resulted in complete failure of our experiment and therefore we would have given up the whole idea. Sometimes efficiency can be a curse."

Graham continued his study with the aid of Cole and later Copher, seeking to find a less toxic compound. The bromide salt was substituted for the iodide, and the first human subject was a Negress in Barnes hospital with a typical history of gallstone colic. Films of this patient before injection of dye showed no stones. After injection of the dye no shadow was obtained of either gallbladder or stones; nevertheless, at operation numerous stones were observed. This was very disappointing to the investigators until it occurred to them that, in all probability, either the diseased gallbladder was unable to concentrate the dye sufficiently to cast a shadow or the common duct was obstructed. They then realized that they probably had discovered a functional test for disease of the gallbladder. They deduced that good visualization of the gallbladder depends on the following factors:

1. A sufficient amount of the dye must enter the blood stream.
2. It must be excreted by the liver into the bile in sufficient amount.
3. It must get into the gallbladder.
4. The gallbladder must be nearly enough normal to concentrate its contents by the adequate absorption of water from the same.

With the help of the Mallinckrodt Chemical Works, these workers developed an isometric compound which could be administered orally, i. e., phenoltetraiodophthalein. This was widely used orally and intravenously until, in 1940, priodax (alpha-phenylpropionic acid) was first produced by Dohrut Diedrich in Germany under the name of "biliselectin." This compound had the advantages of being less toxic, casting clearer shadows and being almost completely absorbed in the small intestine, eliminating confusing shadows of dye in the large bowel.

Recently a new dye, telepaque, has to a considerable extent replaced priodax. In

TABLE 1.—*Symptoms and Signs*

Symptom or sign	*Number of Operative Cases*	*Percentage of Operative Cases*	*Number of Non-operative Cases*	*Percentage of Non-operative Cases*
Pain (right subcostal or epigastric)	15	93.7	53	74.6
Tenderness (right subcostal)	15	93.7	53	74.6
Eructation	16	100	63	87.7
Nausea	15	93.7	54	76
Intolerance to fat	11	68.7	52	73.2
Vomiting	8	50	21	29.5
Nervousness	9	56.2	49	67.6
Constipation	16	100	62	87.3
Obesity	9	56.2	21	29.5
Acute attacks of cholecystitis	13	81.4	23	32.3
More than one acute attack	8	50	18	25.4
Stone visualized	3	18.3	4	5.6
Total	16		71	

Sosman's opinion it has the following advantages:

1. Less nausea and diarrhea and other effects.
2. A greater percentage of gallbladders can be visualized telepaque, 4 per cent not visualized; priodax, 12 per cent not visualized; telepaque, 24 per cent of functioning gallbladders showed stones or polyps and 20 per cent of all gallbladder series showed stones or polyps.
3. The cystic hepatic and common bile ducts are much more frequently visualized.

Shehadi stated that with telepaque the normal gallbladder was observed to respond promptly to a fat meal, contracting to one-fourth of its original size or less in forty minutes.

Mann draws the following hypothesis for the function of the gallbladder: "During fasting the liver produces small amounts of bile, most of which is stored and concentrated in the gallbladder. After a meal acid chyme enters the duodenum and causes the sphincter of Oddi at the ampulla of Vater to relax and the gallbladder to expel its bile. Bile is rapidly absorbed and stimulates the liver to excrete more bile. During the process of digestion there is active flow of bile to and from the gallbladder. This occurs as long as acid chyme flows into the duodenum. In the fasting state most of the bile is stored in the gallbladder by concentration."

Baydew, an anatomist at Harvard, demonstrated in 1922 that complete collapse of the mammal gallbladder could be induced naturally by administration of appropriate food—cream and egg yolk. Olin in 1934 stated, with regard to the physiologic aspects of cholecystography, "The dye salt is eventually excreted by the liver and by the gallbladder. During the passage through these organs, similar to the passage of barium sulfate in gastro-intestinal studies, a shadow will be produced in the x-ray film. The concentration of the gallbladder contents, due to the absorption of water, is primarily responsible for the intense dye shadow which is cast."

From these conceptions it seems not unreasonable to suppose that if the gallbladder wall is diseased or the function of the ducts or their sphincters is disturbed by pathologic processes, this may interfere with the emptying of the gallbladder, so that a shadow remains for a longer period than is normal.

From a search of the literature it appears to be generally agreed that:

1. Given a technically correct examination, failure to visualize the gallbladder indicates a nonfunctioning diseased gallbladder. Sosman stated that this observation is 99 per cent accurate.

2. If a gallbladder contracts normally, showing at least a 50 per cent decrease in size within one to two hours after a fatty meal, this response can be considered an added index of normality.

3. The presence of stones indicates a pathologic condition, if not necessarily poor function.

If a gallbladder fails to contract after a fatty meal, however, Sosman's opinion is that this fact has but doubtful value in diagnosis. Rigler, on the other hand, stated that failure to empty indicates poor function of the gallbladder or valvular obstruction at its neck. These are simply examples of the disagreement that exists as to the significance of the importance of complete emptying of the gallbladder after a fatty meal.

When I first came to this Clinic in 1930, Dr. W. W. Crawford and his associate, Dr. F. D. Bower, considered a gallbladder pathologic if it could still be visualized in the so-called twenty-four hour plate (thirty-nine or more hours after ingestion of the dye). Later I came into contact with many radiologists and surgeons who con-

TABLE 2.—*Results of Medical Treatment*

Operative cases No. 16	*Number*	*Percentage*
Previous major surgery	10	62.5
Good results	0	0
Fair results	0	0
Poor results	16	100
Nonoperative cases No. 71		
Previous major surgery	23	32.3
Good results	37	52.1
Fair results	19	26.9
Poor results	4	5.64

TABLE 3.—*Operative Results*

	Number of Cases	*Percentage*
Operative cases	16	18.3
Good results	12	75
Fair to poor results	3	18.3
Death	1	6.25
Total	87	

sidered "revisualization" of the gallbladder in the twenty-four hour plate of no consequence; in detecting minor degrees of dysfunction, they depended on estimation of the gallbladder's ability to concentrate the dye after the fatty meal. Influenced by these men, I discontinued making the twenty-four hour plate for about two years. I soon found that it was very difficult, if not impossible, to differentiate between normal and abnormal emptying and concentration. For example, variation in roentgen technic between the full film and the two-hour emptying film can make considerable difference in the apparent amount of concentration of the dye, and the size of the gallbladder shadow after the fatty meal, as well as its density, may be influenced greatly by psychic and other factors. Therefore, in 1946, I returned to making the twenty-four hour film and am convinced that use of this film has enabled me to detect low grade symptomatic cholecystitis with greater certainty. Stated briefly, my conviction is that failure of the gallbladder to empty completely (so-called revisualization) thirty-nine or more hours after administration of the dye is indicative of poor function and pathologic change, which may or may not produce clinically apparent symptoms. It was to investigate the correctness or incorrectness of this view that the following study was suggested some months ago by Dr. Andrew Carroll of this Clinic.

The study consists of an analysis of 87 cases in which the gallbladder shadow was

TABLE 4.—*Operative Cases**

	Number	*Percentage*
Gross pathologic change	13	80.1
Microscopic pathologic change	14	87.5
Specimens unsatisfactory	2	12.5
Total Cases	16	

*NOTE: Two specimens were unsatisfactory for microscopic examination. One of these showed marked gross pathologic change. Three specimens were reported as showing "mild chronic cholecystitis."

TABLE 5.—*Gross Pathologic Observations*

1. Adhesions of gallbladder to surrounding structures
2. Stones
3. Enlargement of head of pancreas
4. Fatty degeneration of gallbladder wall
5. "Strawberry" appearance of mucosa
6. Atrophy and stenosis of cystic duct

TABLE 6.—*Microscopic Pathologic Observations (16 Cases)*

1. Chronic cholecystitis	10 cases
2. Leiomyoma of gallbladder and chronic cholecystitis	1 case
3. Chronic cholecystitis and chronic cholelithiasis	2 cases
4. Acute, subacute and chronic cholecystitis	2 cases
5. Cholesterolosis alone	1 case

TABLE 7.—*Primary Reasons for Not Operating*
Total No. of Cases — 71

	Number	*Percentage*
Good results from medical treatment	13	18.3
Other pathologic conditions more urgent	21	29.5
Psychoneurosis	6	8.4
Mild disease or none	18	25.3
Operation refused	10	14.1
Total	71	

TABLE 8.—*Chief Symptoms in Seventy-one Nonoperative Cases*

	Number	*Percentage*
Pain in right upper quadrant or epigastrium	38	53
Nausea	6	8.4
Vomiting	1	1.4
Intolerance to fats	1	1.4
Precardial pain	3	4.2
Other symptoms	49	69
Total	71	

seen in the twenty-four hour plate, i. e., thirty-nine or more hours after oral administration of the dye. Some of the cholecystograms in these cases were done with telepaque and some with priodax.

Of the 87 patients, 16 came to operation and were cholecystectomized. Seventy-one were not operated on.

In analyzing these cases my associates and I were interested in finding out: (1) To what extent definite symptoms and signs of disease of the gallbladder existed; (2) what percentage responded to medical therapy; (3) what percentage came to operation; (4) what percentage revealed definite pathologic change at operation, and (5) what were the clinical results of operation, as nearly as could be judged?

Table 1 lists the physical signs, symptoms and acute attacks usually thought of as associated with cholecystitis and their frequency of occurrence in 87 cases in which the gallbladder dye shadow was visible in the twenty-four hour plate. Table 2 analyzes the results of medical therapy in both operative and nonoperative cases and indicates the number of patients who had previously undergone major surgical procedures. In Table 3 are shown the postoperative results in 16 operative cases; Table 4, the prevalence of gross pathologic change among the patients operated on, and Table 5, that of microscopic pathologic changes in the same patients. Table 6 lists the microscopic pathologic observations in detail. In Table 7 will be found the bases on which it was decided not to operate in 71 cases; in Table 8, the chief clinical symptoms in these cases.

SUMMARY AND CONCLUSIONS

The authors do not expect to draw any definite conclusions from such a small number of cases as that presented in this article. However, in their opinion the study at least indicates that there is a relation between failure of the gallbladder to empty completely in thirty-nine or more hours and pathologic change in this organ or its ducts. In a large majority of their cases this observation was associated with clinical symptoms sufficiently marked to bring the patient to the physician, and, of those operated on, 80 per cent or more showed definite pathologic change in the gallbladder.

Obviously it is easier to determine whether or not the gallbladder is visualized in the twenty-four hour plate than it is to determine the amount of emptying or concentration that has occurred in the two-hour film after a fatty meal.

Frequently the pathologic condition is mild and the symptoms respond to medical and dietary treatment, but the authors consider the operation justified when definite clinical symptoms and signs of cholecystitis are noted in the presence of a gall-

bladder which was visualized thirty-nine or more hours after administration of the dye. The patients, however, should be thoroughly studied for other disease of the gastrointestinal tract prior to the decision to operate.

ZUSAMMENFASSUNG

Obgleich sich die Verfasser nicht berechtigt fühlen, endgültige Schlüsse auf Grund ihrer Beobachtungen an der kleinen Anzahl der in dieser Arbeit vorgestellten Fälle ziehen zu können, so glauben sie doch, eine Beziehung zwischen einer unvollständigen Entleerung der Gallenblase innerhalb von 39 undr mehr Stunden und krankhaften Veränderungen in der Gallenblase oder den Gallengängen entdecken zu können. In der überwiegenden Mehrzahl ihrer Fälle ging ihre Beobachtung mit klinischen Erscheinungen einher, die schwer genug waren, den Patienten ärztliche Hilfe suchen zu lassen, und in achtzig oder mehr Prozent der Fälle, die zur Operation kamen, ergaben sich ausgesprochene krankhafte Veränderungen der Gallenblase.

Es ist offensichtlich leichter, die Füllung oder Nichtfüllung der Gallenblase am Film 24 Stunden nach Einnahme des Mittels festzustellen, als zu entscheiden, welche Menge des Mittels zwei Stunden nach Verabreichung einer Fettmahlzeit entleert oder konzentriert worden ist.

Die Erkrankung ist oft leichter Natur und spricht auf medizinische und diätetische Behandlung an. Die Verfasser glauben jedoch, dass beim Bestehen ausgesprochener klinischer Symptome und bei Anzeichen von Gallenblasenentzündung bei gleichzeitiger Beobachtung eines bestehenden Gallenblasenschattens 39 oder mehr Stunden nach Verabreichung des Kontrastmittels operatives Vorgehen gerechtfertigt ist. Allerdings muss der Kranke, bevor der Entschluss zur Operation gefasst wird, sorgfältig auf andere Erkrankungen des Magendarmkanals untersucht werden.

RIASSUNTO

Gli autori non si sentono di trarre alcuna conclusione di carattere definitivo da una serie di casi così modesta, tuttavia essi credono di poter affermare che vi è un rapporto fra l'incapacità della colecisti di svuotarsi completamente entro 39 ore e la presenza di alterazioni patologische della colecisti stessa o dei dotti. Nella grande maggioranza dei loro casi questo sintomo si accompagnava a disturbi marcati e, nell' 80% dei pazienti operati, a lesioni evidenti della colecisti.

E' assai più facile, ovviamente, decidere se una colecisti è ancora visibile dopo 24 ore che non valutare l'entità del suo vuotamento dopo 2 ore.

Sovente la lesione è lieve e i disturbi sono dominabili con la cura medica, ma l'intervento chirurgico è giustificato in presenza di un quadro clinico di colecistite in un malato in cui la colecisti sia ancora visibile dopo 39 ore dalla somministrazione del mezzo opaco. Naturalmente il paziente dovrà essere studiato anche sotto altri punti di vista.

SUMÁRIO E CONCLUSOES

Os Autores não esperam tirar conclusões definitivas de um numero tão pequeno de casos como os apresentados neste artigo. Contudo, em sua opinião, este estudo pelo menos indica haver uma relação entre a falta de esvasiamento completo da vesicula biliar em trinta e nove horas ou mais e alterações patologicas deste argão ou seus ductos. Numa grande maioria de seus casos esta observação foi associada a sintomas clinicos suffcientemente nitidos para levar o pacient ao medico e, daqueles operados, 80% ou mais apresentavam alterações patologicas definidas na vesicula.

. Evidentemente é mais facil determinarse se a vesicula é visivel ou não na radiofrafia de vinte e quatro horas do que a determinação da taxa de esvasiamento ou concentração que tenha ocorrido na radiografia de duas horas, após uma refeição gordurosa.

Frequentemente a condição patologica é de natureza leve e os sintomas respondem ao tratamento medico e dietetico, mas os autores consideram a operação justificada quando os sintomas clinicos definidos e os sinais de colecistite são notados na presence de uma vesicula biliar que tenha sido visualizada trinta e nove horas ou mais após a administração do contraste. Contudo, os pacientes devem ser minuciosamente estudos em busca de outras afecções do tracto gastrointestinal, antes que seja feita a indicação operatoria.

RÉSUMÉ

Les auteurs ne demandent pas à faire des conclusions définitives du petit nombre de cas qu'ils présentent dans cet article. Tout de même à leur opinion l'étude clinique indique au moins, qu'une rélation existe entre l'inabilité de la cholécyste d'evacuer complètement en 39 heures et des conditions pathologiques dans cet organ ou ses conduits. Dans une grande majorité de leurs cas cette observation était accompagnée de symptômes clinicaux essez graves, pour faire le malade consulter le médecin, et de ceux qui furent operés, 80% ou plus présentaient des conditions définitivement pathologiques de la vésicule biliaire.

Sans doute il est plus facile, de déterminer, si la cholécyste est vide ou pas sur un film pris après 24 heures, que de déterminer le degré d'élimination ou concentration sur un film pris 2 heures après un repas gras.

Souvent la condition pathologique est legere et les symptomes disparaissent après un traitement médical et diététique, mais les auteurs considèrent une opération justifiée, si on constate des symptomes définitives de cholécystite en présence d'une vésicule biliaire qui est visible 39 heures après l'administration du contraste, ou plus tard. Tout de même le malade doit être examiné carément pour d'auters maladies du tube digestif, avant de décider à opérer.

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Systems, scientific and philosophic, come and go. Each method of limited understanding is at length exhausted. In its prime each system is a triumphant success: in its decay it is an obstructive nuisance.

It is a profoundly erroneous truism, repeated by all copybooks and by eminent people when they are making speeches, that we should cultivate the habit of thinking of what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them. Operations of thought are like cavalry charges in a battle—they are strictly limited in number, they require fresh horses, and must only be made at decisive moments.

—*Whitehead*

Steroid Anesthesia in Man: Clinical and Cerebral Metabolic Effects

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OUR interest in the effect of hormones upon the central nervous system originated from the now well-documented observation that disturbed mental or psychologic function is common in many endocrine disorders. The well-known mental aberrations of myxedema, hypoglycemia, hypoparathyroidism and hyperparathyroidism, hypopituitarism and Addison's and Cushing's diseases are too familiar to require rehearsal here. The widespread use of cortisone and corticotrophin (ACTH) has dramatized the feeling of well-being and exhilaration, as well as the psychoses and convulsions, that these agents may precipitate. The effect of steroids on electroshock seizure threshold has been thoroughly studied by Woodbury,[1] who has shown in the rat, as we have observed in man, that desoxycorticosterone is a potent anticonvulsive agent. This was first noted in 2 epileptic patients by McQuarrie, Anderson and Ziegler[2] in 1942 and confirmed in a larger series by Aird and Gordan[3] in 1951.

An inhibitory effect of steroids upon central nervous system activity was suggested by experiments which Selye[4] reported in 1941. He showed that certain steroids produced anesthesia in rats and in fish and that anesthetic potency did not parallel any of the known hormonal activities of these compounds. Among the most potent agents were desoxycorticosterone, progesterone and pregnandiol, the hormonally inert metabolite of progesterone. Since Michaelis and Quastel[5] had proposed an enzymatic mechanism of action for anesthesia, Gordan and Elliott undertook similar studies of the action of steroids upon brain tissue *in vitro*. Steroids observed by Selye to have anesthetic potency showed parallel inhibitory activity of the oxygen uptake by rat brain cells *in vitro*, but the site of action appeared to be at the dehydrogenase level rather than the cytochromes.[6] That the steroids normally exert a regulatory influence upon cerebral metabolism is suggested by the high rate of oxygen uptake of the brain of the castrate immature male rat.[7] Similar high rates are found in normal preadolescent children[8] and in patients who have never undergone puberty because of testicular or pituitary defects.[9] In the case of the castrate immature male rat it is possible to reduce the accelerated rate of oxygen uptake *in vivo* or *in vitro* by the administration of various steroids.[10] From these studies it appears that steroids with the

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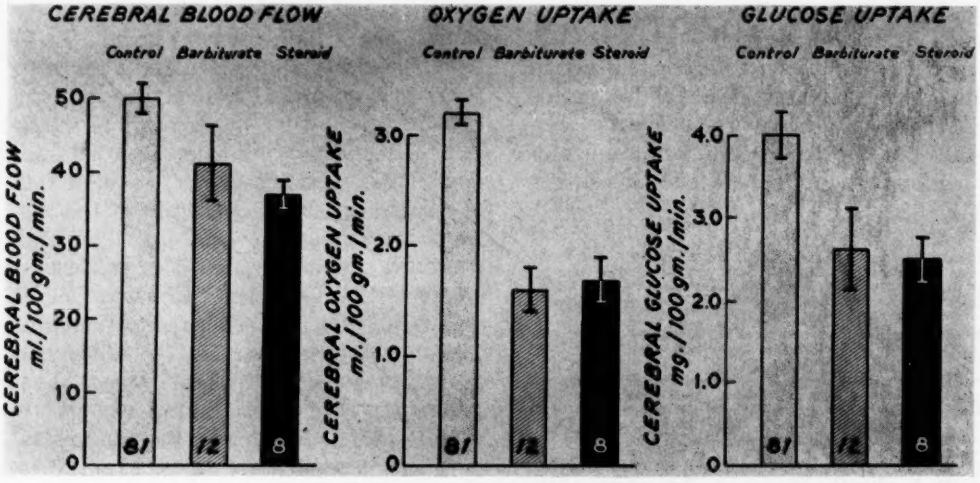
androstene nucleus, including testosterone and 21-C steroids, are effective in restoring the "braking" action normally exerted by the sex hormones upon cerebral metabolism.

The water-soluble steroids, desoxycorticosterone glucoside (DCG) and sodium or potassium testosterone sulfate, in doses as large as 250 mg. intravenously, have not produced anesthesia in human subjects. Recently, Merryman and others[11] have observed light hypnosis in patients receiving progesterone dissolved in propylene glycol and human albumin intravenously. We have sought a steroid capable of inhibiting the dextrose and oxygen uptake of the brain but devoid of endocrine or salt-retaining activity as a possible means of inducing anesthesia in man. Recently Laubach, P'an and Rudel[12] of Pfizer Laboratories have observed that the steroid 21-hydroxypregnanedione-3,20 (viadril) induces anesthesia in mice, rats, cats, dogs and monkeys. The purpose of this communication is to report its action in man.

The water-soluble sodium salt of the steroid hemisuccinate ester was administered intravenously without barbiturate or narcotic premedication to 5 schizophrenic patients and to 3 normal subjects. Anesthesia, consisting of loss of consciousness, insensibility to pain, absence of corneal reflex and presence of muscular relaxation, was produced in 6 of these patients. The first 2 were given the agent only to the point of hypnosis. These 2 had pronounced salivation; this was prevented in subsequent patients by the prior administration of atropine sulfate, 0.6 mg. intravenously. Respiratory depression did not occur during the slow intravenous infusion of viadril in these 8 patients. Pain in the course of the brachial vein was noted when the administration was rapid or the solution was concentrated to 2.5 Gm. per hundred millimeters or more. Hypnotic and anesthetic effects were induced after a lag period of three to ten minutes after the slow intravenous administration of the agent. Recovery was rapid and patients were able to reply to questions eighteen to forty minutes later; seventy-three minutes in the case of the patient who was given 2,000 mg. No depression or other untoward after-effects were observed, except pain in the antecubital fossa and forearm of 1 pa-



Cerebral blood flow and metabolism during anesthesia.

tient. Because the intravenous administration of the water-soluble androgens, testosterone 17-beta-diethyl-amino-ethyl-carbonate hydrochloride and sodium testosterone sulfate, has been reported to cause hemolysis,[13] we have checked the plasma and urine of our patients for hemoglobin. In our experience hemolysis has not occurred after the administration of viadril.

The effect of this agent upon cerebral blood flow (CBF) and cerebral metabolism was measured by the original Kety-Schmidt technic.[14] In each patient a control determination was made prior to the administration of the agent and a second determination twenty minutes later, during the period of clinical effect. The data are graphed in the accompanying chart; for comparison, the rates of cerebral metabolism of oxygen and dextrose in 12 patients anesthetized with combined thiopental sodium, pentobarbital sodium and meperidine hydrochloride are also presented.

The clinical use of viadril as an anesthetic agent for 125 surgical procedures has been studied by Drs. Murphy, Guadagni and DeBon and will be reported by Dr. Murphy. I shall restrict my discussion to the implications of steroid anesthesia in man. The use of a physiologic mechanism, namely the application of the steroid "brake" to cerebral dextrose and oxygen uptake may have some theoretical advantage over the pharmacologic action of the barbiturates. It will be noted that steroid-induced inhibition occurs at a different enzymatic level than does that produced by barbiturates. The lack of respiratory depression from the administration of this agent to patients is undoubtedly a practical advantage. Drs. Eisenberg and Margolis of my laboratory have attempted to use viadril as a "truth serum," without success. The patients are immediately anesthetized and show no cortical release, which suggests that the compound is a true anesthetic rather than a mere hypnotic agent.

I am sure that the surgeons and anesthesiologists would like this compound to act more rapidly. We believe we have a clue to the reason for the lag of approximately four minutes between the administration and the effect of the agent. Dr. H. W. Elliott and Mrs. Vee Sutherland of the Department of Pharmacology, University of California School of Medicine, have studied the action of the unesterified steroid upon the respiration of rat brain slices *in vitro*. They observed a delay of one hundred and twenty minutes before oxygen uptake was inhibited. The lag, observed both *in vivo* and *in vitro*, suggests to us that the compound is converted to an active metabolite. We assume that the conversion is produced more rapidly by the patient's liver than by the small amount of brain tissue in the Warburg flask. Currently we are attempting to isolate and identify such a metabolite in the hope of obtaining more rapidly acting anesthetic agents which will probably be effective in smaller doses.

SUMMARY

The sodium salt of the hemisuccinate ester of the steroid 21-hydroxypregnanedione-3,20, administered intravenously to human subjects, produces anesthesia and cerebral metabolic changes identical with those produced by barbiturates but without respiratory depression.

RIASSUNTO

Il sale sodico dell'estere emisuccinato del 21-idrossipregnanedione-3,20, somministrato per via endovenosa produce nell'uomo un'anestesia analoga a quella da barbiturici, senza determinare depressione respiratoria.

RÉSUMÉ

Le sel de sodium de l'ester hemisuccíné 21-hydropregnanedione 3,20, donné par la

voie veneuse, produit l'analgésie et les changements metaboliques cérébraux, identiques à ceux qui sont produits par les barbituriques, mais sans dépression respiratoire.

ZUSAMMENFASSUNG

Die intravenöse Verabreichung des Natriumsalzes des Hemisuccinatesters des Steroids 21 - Hydroxypregnanedion-3, 20 ruft beim Menschen Anästhesie und zerebrale Stoffwechselveränderungen hervor, die mit denen durch Barbitursäurepräparate erzielten identisch sind, jedoch ohne Atmungsdepression einhergehen.

RESUMEN

La sal sódica del éster homisuccinado del esteroide 21, hidroxipregnanediona, administrado intravenosamente en el hombre produce anestesia y cambios metabólicos cerebrales idénticos a aquellos producidos por los barbitúticos, sin tener el efecto de depressión respiratoria.

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So great is our idea of the grandeur of the human soul that we cannot bear its contempt, or to be deprived of its esteem. All the happiness men enjoy consists in such esteem.

Those who despise men most, putting them on a level with the beasts, nevertheless wish for their admiration and confidence. Thus their own feelings contradict them. For their nature, which is stronger than aught else, convinces them more strongly of the greatness of man than reason convinces them of their vileness.

—*Pascal*

Steroid Anesthesia in Man: A Clinical Report

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IT has been noted as a matter of academic interest (Selye[1]) that some steroids produce a state of hypnosis or anesthesia.

Laubach, P'an and Rudel[2] subsequently investigated a large number of steroids for their anesthetic potency, therapeutic index, toxicity and duration in animals and found 21-hydroxy-pregnanedione sodium succinate to be most satisfactory. This compound was first identified by the code designation "P-55" and has since been given the name "viadril."

The drug was administered to human subjects by Gordan and associates,[3] who have reported its effect on cerebral metabolism in man. The department of anesthesiology of the University of California then began studying the characteristics of this drug as a practical anesthetic agent in the operating room.

Viadril is a white crystalline powder, soluble in water and having a molecular weight of 432. The resultant solution has a *p*H of 8.5 to 9.8. Its chemical structure is that of a steroid, and is shown in the column opposite.

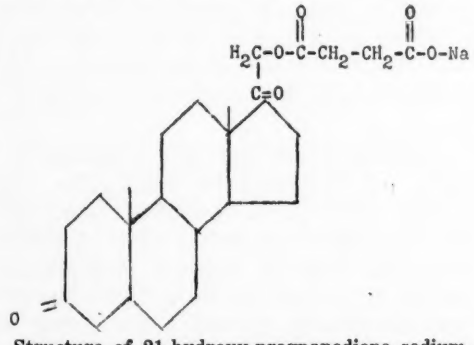
Animal experimentation has shown that viadril has no hormonal effects, causes no salt retention in therapeutic doses and no demonstrable toxic effects on vital organs (Laubach and others[2]), when administered in anesthetic doses. This paper reports the first administration of viadril to a wide variety of surgical patients under ordinary operating room conditions.

We have used viadril as a basal anesthetic in these cases, supplemented usually by nitrous oxide. Work with animals demonstrates that, with larger doses, no supplement was necessary to produce anesthesia. For safety and control, however, we limited intravenous doses and supplemented them with inhalation agents in all but a few cases.

Table 1 classifies the patients as to age and sex. Table 2 lists the operations performed, together with their durations.

Technic.—Viadril has been administered in solution in both distilled water and physiologic solutions of sodium chloride. In either case a 2.5 per cent solution is freshly prepared. An intravenous drip of 5 per cent dextrose in distilled water is started in a vein of the arm. This should run freely. During administration of viadril the stop clock is left wide open.

The viadril solution is injected into the intravenous tubing at a point some distance from the arm, so that mixing and



Structure of 21-hydroxy-pregnanedione sodium succinate (Viadril).

From the Department of Anesthesiology of the University of California School of Medicine, San Francisco.
Viadril was supplied by Pfizer Laboratories, Inc.
Read at the Twentieth Anniversary Congress of the International College of Surgeons, Geneva, Switzerland, May 23-26, 1955.
Submitted for publication July 5, 1955.

TABLE 1.—*Age and Sex of Patients*

Age, Years	*No.*
1-10	0
11-20	4
21-30	15
31-40	22
41-50	37
51-60	22
61-70	18
71-80	7
Total	125
Sex	
Male	49
Female	76
Total	125

dilution take place in the tubing before the needle is reached. This injection takes place slowly, so that the drug is washed into the vein with a large amount of the solution. We calculate the strength at which the viadril solution enters the vein as not greater than 1.25 per cent and usually much more highly diluted than this. Generally, we have made the injection into arm veins rather than leg veins, since thrombosis is more likely to occur in the latter. An occasional patient will complain of pains in the arm, but these can be eliminated by reducing the rate of injection. It usually takes about five minutes to give 1,500 mg., and five additional minutes are allowed before the patient is considered ready for any further manipulation.

Although we do not use a standard formula for preanesthetic medication, the average adult patient comes to the operating room after having had 50 to 75 mg. of Demerol, with or without scopolamine, and pentobarbital. Thus, he is not heavily premedicated or drowsy upon arrival in the operating room. This premedication is not changed for patients receiving viadril. We have usually used the drug as a basal anesthetic in combination with nitrous oxide and oxygen. We also have used it in combination with cyclopropane and oxygen and with ether, as well as with the barbiturates and additional doses of narcotics. We also have used muscle relaxants when necessary. The usual supplement has been nitrous oxide and oxygen in the proportion of 3:1, with or without supplemental doses of meperedine.

Results. — This combination of agents has given us highly satisfactory results. With viadril as a base, nitrous oxide becomes a satisfactory, adequate and controllable anesthetic agent. It might be said that viadril has given nitrous oxide the added potency to make it an adequate anesthetic without detracting from its safety and controllability. The use of viadril, combined with different anesthetic agents, reduces the amount of the other drugs necessary.

When given as a preliminary to ether, it allows a smooth induction and markedly decreases the amount of ether required. Gordan and his associates[3] noted that the effect of viadril lasted from eighteen to seventy-three minutes, depending upon the dose. Although their observations were made on patients not necessarily at surgical levels of anesthesia, when the drug is fortified with nitrous oxide and oxygen, or other anesthetic agents, the effect seems to last much longer.

One craniotomy in our series lasted nearly eleven hours. Upon discontinuation of the inhalation agent the patient awakened very promptly and was in excellent postanesthetic condition. Patients under viadril one and one-half to two hours also recover promptly upon discontinuation of the inhalation agent.

In those cases in which intratracheal intubation is planned, it is undertaken about ten minutes after the initial via-

TABLE 2.—*Operations*

Operations	*Intubated*		*Meperidine, Mg.*					*Curare, Mg.*			
Region	No.	No.	1-50	51-100	101-150	151-200	201-250	1-9	10-21	22-33	40
Intracranial	15	15	3	4	4	1					
Intrathoracic	9	9	3	2		2		2	2	1	
Abdominal											***
Upper	17	16	4	6	2		1*	4	6	3	1
Lower pelvic	8	8	2	2	1	1		4	3	1	
Kidney	4	4	1	2				1	1		
Neck	35	23	12	8	6						
Extremities	9	3	2	1	4		1**	1	1		
Perineal	8	1	6	2							
Back	9	5		4							
Chest wall	3		1	1							
Pneumoencephalogram	1										
E.E.N.T.	7	7	2	3	1						
Total	125	91	36	35	18	4	2	12	13	5	1

* Age 65—90 Kg. Gastrectomy—Meperidine 210 mg. dTc 40.5 mg. 6'50".
** Age 33—84 Kg. Median Neurolysis Meperidine 235 mg. dTc 6 mg. 5'30".
*** One case with succinylcholine drip.

dril has been administered. Although the patient may cough when the larynx is disturbed, if the procedure is conducted gently it is almost always possible to accomplish intubation without any difficulty. This may be followed by some slight coughing, but it has not been characterized by laryngospasm or severe breath holding. Very rarely have we found it necessary to administer a relaxant to assist in intubation. A relaxant was necessary only when the initial dose of viadril was insufficient and when subsequent increments were given with good results, or when exceptional physical difficulties existed. Sometimes meperedine, 25 to 50 mg., has been administered immediately after intubation, with the result that whatever coughing there may have been is controlled. As soon as the intratracheal tube has been introduced, the patient is given nitrous oxide and oxygen in the proportion of 3:1.

Most patients undergoing abdominal operations are found to require relaxation greater than that produced by the viadril and nitrous oxide-oxygen. These are given a muscular relaxant, either d-tubocurarine or one of the synthetic preparations, in amounts sufficient to produce the desired results. It has been observed, however, that the amounts necessary are approximately one-third to one-half the estimated dose if the patient had been receiving pentothal instead of viadril. Relaxants have also been given to produce apnea for controlled respiration in certain thoracic operations.

It has been observed that many patients who are breathing spontaneously will allow the anesthesiologist to control respiration without the use of a relaxant. It has not been necessary to administer any relaxant drugs to patients who are undergoing operations that do not require unusual relaxation.

The marked effect upon the laryngeal reflexes has been noted. Patients who are not deeply anesthetized will show some movement upon being strongly stimulated by the initial cutaneous incision. These patients will usually settle down, however, and do not require additional medication.

Complications.—We have used this drug in 125 cases up to the time of writing. In this series some twenty different surgical procedures have been done. On three occasions, thrombophlebitis has developed in the vein in which the viadril was administered. We are reminded of Lundy's experience with the administration of dolitrone.[4] In each of our cases the patient also was lying prone, with the arms above the head, and there seems to have been an excellent possibility of a pooling in the vessel. In addition, each of the patients was anesthetized for an aortagram, and each certainly had marked endarteritis in some vessels. Whether the veins into which the viadril was injected also had some pathologic condition of the venous wall is a question, but, if so, it may have contributed to the result. Aside from this, none of our patients has had any complications following the use of viadril.

COMMENT

There seems to be an inevitable tendency to compare viadril with pentothal sodium in considering its clinical action and usefulness. We look upon this as somewhat unfortunate. In our opinion, viadril is pharmacologically dissimilar to pentothal sodium; the former is an anesthetic, the latter a hypnotic. Barbiturates, used in nondepressant therapeutic doses, produce only sleep. To be used as anesthetics, they must be given in doses sufficient to produce marked depression, particularly of respiration. In the case of viadril the desirable therapeutic effects are produced by doses that do not bring about this depression.

TABLE 3.—*Duration of Anesthesia*

Duration, Hr.	
0-1	5
1-2	20
2-3	28
3-4	30
4-5	15
5-6	11
6-7	12
7-8	2
8-9	1
9-10	1
Total	125

As with other general anesthetic agents, hypnosis is an incidental effect of the drug. It is our opinion that viadril is most properly classified as a true anesthetic. In therapeutic doses it abolishes pain sensitivity, dulls reflexes and produces muscular relaxation and sleep, all without undue depression of either respiration or circulation.

Since it produces all these effects, but not to an "ideal" degree, viadril should not be classified as a strong anesthetic, and for our purposes we have placed it just below cyclopropane and above ethylene with respect to total effectiveness or potency. Not being an exceptionally potent anesthetic, it finds its greatest usefulness as a so-called basal anesthetic. Viadril has given us very satisfactory results when used in this way.

We are currently studying certain pharmacologic actions of viadril in man, which we shall report in a later paper. Electroencephalographic and electrocardiographic studies are under way.

Our experience up to the time of this report indicates that viadril is a therapeutically useful drug in the field of anesthesiology and that its continuing use and investigation will prove profitable. It is

quite possible that other steroid compounds will be discovered which will exhibit even more useful anesthetic properties. The present work should prove an encouragement to further search.

SUMMARY

A steroid compound that does not have hormonal activity in the doses used but is useful as an anesthetic has been produced and made available for clinical use. The drug has been given 125 times as a basal anesthetic under ordinary operating room conditions. The technic for administration is described. Clinical results are given. The only complication noted was chemical thrombophlebitis, which occurred in 3 cases.

ZUSAMMENFASSUNG

Es wird über die Herstellung einer Steroidverbindung berichtet, die in der verabreichten Dosierung keine hormonale Aktivität besitzt, aber als Anästhetikum wirksam ist und zum klinischen Gebrauch zur Verfügung steht. Das Mittel ist 125 mal als Anästhetikum unter den üblichen Krankenzimmerbedingungen angewendet worden. Die Technik der Verabfolgung und die klinischen Ergebnisse werden beschrieben. Als einzige Komplikation wurde in drei Fällen eine chemische Thrombophlebitis beobachtet.

RÉSUMÉ

Une composition stéroide a été produite et mise en circulation pour l'usage clinique, qui n'a pas d'activité hormonale dans la dose employée, mais qui peut servir comme analgésique. Le produit a été donné 125 fois comme analgésique basique dans des conditions normales. La technique d'administration et les résultats clinques sont décrits. La seule complication qu' on a vu était une thrombophlébite clinique, qui était observée dans trois cas.

RIASSUNTO

E' stato prodotto e messo in commercio uno steroide sprovvisto di attività ormonica ma utile come anestetico. Questo farmaco è stato usato in 126 casi come anestetico di base, secondo una tecnica che viene descritta. Unica complicanza una tromboflebite chimica, che si verificò in 3 malati.

RESUMEN

Se dispone para uso clínico de un compuesto esteroide que en las dosis usadas no tiene acción hormonal pero resulta útil como anestésico. La droga ha sido administrada 125 veces como anestésico basal. Se describe la técnica de administración. Se consignan los resultados clínicos. La única complicación que se observó fué una tromboflebitis química que ocurrió en 3 casos.

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Intra-Arterial and Subcutaneous Oxygen in the Treatment of Peripheral Arterial Disturbances

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INTRA-ARTERIAL oxygen was first used by the Fiolle brothers[1] in 1914 to inject the carotid artery for the treatment of gas gangrene. Morphy[2] used intra-arterial oxygen for the therapy of pneumonia in 1920. Results of this therapy were not encouraging. During a study for arteriography with intra-arterial oxygen, Lemaire, Loeper and Housset[3] noticed vascular changes seemingly beneficial to the patient.

In 1949 one of us (F. J.)[4] started to investigate intra-arterial oxygen therapy in the treatment of peripheral arterial diseases. In conjunction with the intra-arterial oxygen therapy in some of the patients, several different vasodilators were evaluated. Subsequently the use of intramuscular and subcutaneous oxygen was also introduced into the study. We designed an apparatus that accurately controlled administration of intra-arterial oxygen. Incidentally, it was also found that roentgen arteriopneumographic observation was possible during therapeutic administration of intra-arterial oxygen and in many cases provided adequate delineation of the vascular disease, thus removing the necessity for angiographic procedures with radiopaque materials.

Effect of Oxygen. — Intra-arterial oxygen, because of its long-lasting effect, low cost, simplicity of administration and ready availability, is superior to previously tested drugs such as priscoline, hydergine, roniacol, padutin, acetylcholine chloride and histamine phosphate. The same advantages give it preference over rhythmic massage of the peripheral vessels synchronously with the pulse wave, which has been applied with an apparatus called syncardon.* In cases of far advanced peripheral arterial disease with large areas of gangrene, no remarkable improvement was noted. The best results were obtained in those cases in which the only symptom was intermittent claudication or in which there was evidence of re-

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cent gangrene. Intra-arterial oxygen is also effective in the treatment of patients who have total occlusion of a main artery and whose collateral circulation is only poorly developed. In these patients intra-arterial oxygen greatly aids the development of the collateral circulation.

A 38-year-old white man with a history of multiple duralumin injuries was treated in an Army field hospital during World War II on an emergency basis, receiving only first aid. He entered the hospital in 1943, a few weeks after his injuries. Examination revealed multiple duralumin splinters in all extremities. All open wounds on admission were débrided and healed by first intention except in the right calf, where severe cellulitis developed, requiring a midthigh amputation.

The duralumin splinters in the left leg and upper extremities caused no clinical reaction. Six years later, however, the patient returned with the chief complaint of intermittent claudication of the calf muscles, rest pain, cold left foot with gangrene of the big toe, and cold hands. Roentgen examination revealed no evidence of duralumin fragments. These fragments had not become sequestered but had been absorbed. The impression was that in all probability the absorption of this light metal caused a localized toxic reaction manifesting itself as generalized endarteritis obliterans. Examination revealed the following data:*

Left Upper Extremity
Fingers: coldness, rubor
Pulses: radial 1
cubital 2
brachial 3

Right Upper Extremity
Fingers: coldness, rubor
Pulses: radial 1
cubital 1
brachial 3

Left Lower Extremity
Coldness, dependent rubor, pallor on elevation, superficial gangrene left great hallux
Pulses: femoral 3
popliteal 0
dorsalis pedis artery 0
tibialis 0

Right Lower Extremity
Amputation stump healed by first intention
Pulses: femoral 3

*The quality of the pulse is based on a grading of 0 to 4.

Thoracoscopic sympathectomy by the Kux method was performed, the thoracic sympathetic chain being visualized through an endoscope. This relieved all signs and symptoms of endarteritis obliterans in the upper extremities. The signs and symptoms referable to the lower extremity, however, were unimproved by a left lumbar sympathectomy performed on the first to the fourth lumbar neural arch. After two months, injections of 100 cc. of intra-arterial oxygen thrice weekly were instituted and continued for four weeks. In addition, injections of 200 cc. of subcutaneous oxygen were given once a week for localized gangrene in the great toe. Great symptomatic improvement occurred after four weeks of treatment. All symptoms, including intermittent claudication, were absent after six weeks. The superficial gangrene on the left great toe disappeared. Arteriograms revealed good collateral circulation. After remission of all signs and symptoms, the oxygen treatment was continued for four years because of the patient's fear of losing his remaining leg. During this four-year period the patient was given 165 intra-arterial oxygen injections.

In our opinion this case demonstrates the harmlessness of intra-arterial oxygen treatment when employed under proper conditions. In many patients one injection caused lasting remission of all signs and symptoms after other commonly used methods had given only short periods of relief.

Oxygen therapy causes more loops of capillaries to dilate than does any other form of treatment. This was revealed by studying the base of the great toenail under the microscope during various forms of therapy (Fig. 1). Our criterion for judging improvement of peripheral circulation was the demonstration, under the capillary microscope, of the following changes:

1. Increased capillary dilation
2. New capillary formation
3. Increased capillary blood flow
4. Continuous capillary blood flow
5. Straightening of the capillaries.

For comparison, the following drugs were used:

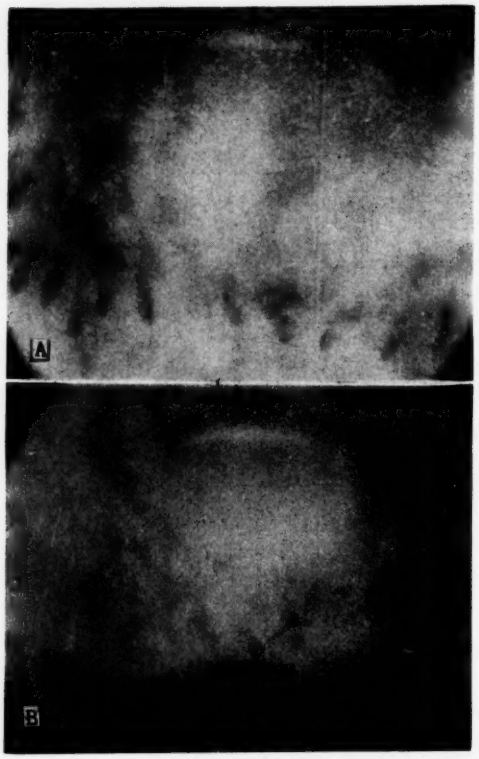

Fig. 1.—*A*, photomicrograph of the vascular bed of the big toe through the base of the big toe nail, prior to intra-arterial injection of oxygen. The single arrow indicates the artefact. The remaining arrows point to the visible capillaries. *B*, identical area as recognized by the artefact in the nail, showing the capillary dilatation. The increased number of capillaries as compared with the first photograph (1*A*) is probably due to empty capillaries which could not be visualized in the first photomicrograph. The arrow indicates the artefact.

Priscoline 2-benzyl-4, 5-amidazoline hydrochloride)

Hydergine (methane sulfonates of dihydrogenated ergotoxic alkaloids)

Roniacol (beta-pyridyl carbinol)

Padutin (brand of vascormone)

Acetylcholine chloride

Histamine phosphate.

All of these drugs, with the exception of acetylcholine, failed to cause much improvement in the capillary picture.

In 85 per cent of the patients it was observed that the capillary bed became greatly enlarged and showed symptomatic improvement. In 15 per cent the capillary bed did not improve, and it was in these patients that no clinical or symptomatic improvement occurred.

Complications.—At the time of writing, more than 4,000 injections of intra-arterial oxygen have been given to 235 patients. If the proper technic and equipment are used there is very little danger of complications. The procedure is certainly no more hazardous than a lumbar parasympathetic block.

Errors in technic include (1) injection of the oxygen in the femoral vein, resulting in pulmonary gas embolus, and (2) too rapid and forceful oxygen injection, which may cause a retrograde flow via the iliac artery, aorta, carotid artery, or left vertebral artery, manifesting itself as cerebral gas embolism.

When oxygen is injected at the proper rate the filling is limited to the distal arterial tree. If given in excess of the proper rate, the proximal arterial vessels will also fill. Should the oxygen reach the epigastric vessels, the patient has the urge to void or defecate, and hyperemia of the skin on the lower part of the abdomen is observed. Though these signs and symptoms are alarming, no harm results from the oxygen injection if promptly discontinued.

In this series only one serious complication occurred in 235 patients treated with intra-arterial oxygen.

A 69-year-old white man entered the outpatient department for vascular diseases in 1949. After examination a diagnosis of arteriosclerotic peripheral arterial disease was made. The symptoms were those of intermittent claudication. Acetylcholine and oxygen were given intra-arterially, and within three weeks the intermittent claudication disappeared. Throughout the period the patient was treated as an outpatient. After ten weeks he returned for oxygen therapy because of a recurrence of intermittent claudication. He

was then given two more courses of intra-arterial oxygen injections and remained free from symptoms for one year. When the third course of oxygen therapy was started, the patient fainted when he arose and attempted to dress.

The pathologic picture was that of left cerebral cortical irritation accompanied by epileptic-form convulsions on the following day. Examination of the fundus at the time of the first attack showed no free gas in the fundic arteries. After several days the signs of cortical irritation and the convulsions disappeared, but the patient still had limitation of his vision.

He was discharged two weeks later, with partial visual loss. He was able to see and count fingers 10 feet (253.8 cm.) away. Further investigation revealed that this patient had had two epileptic seizures of the grand mal type prior to treatment. The patient had concealed this fact on admission; after the complications occurred, he admitted the attacks. Had he done this on admission, intra-arterial oxygen would not have been administered, as epilepsy is a definite contraindication. Because of the patient's past history, we cannot be certain whether he had a cerebral vascular accident or a cerebral gas embolism. Since the puncture was definitely in the femoral artery, the only possible way for gas embolism to occur would be by retrograde flow, as has been explained. To prevent a recurrence of this possible complication, we have taken these precautions:

1. The patient must remain supine for several minutes after the injection.
2. The extremity is moderately elevated for several minutes immediately after the injection.
3. The vessel is auscultated during and after the injection, when a susurrus should be heard.
4. When the arterial susurrus is no longer heard, the surrounding tissue is palpated for gas crepitation due to the fact that the oxygen has reached the surrounding tissues.

Today all patients treated with intra-arterial oxygen in the vascular clinic are on the outpatient basis. Intra-arterial oxygen therapy is not used in the upper extremity, because the brachial artery is much too close to the carotid artery, increasing the probability of cerebral gas embolism. For peripheral vascular disease in the upper extremity, the Kux method of thoracoscopic sympathectomy should be employed.[5]

Technic. — The intra-arterial oxygen insufflation technic is as follows: From an oxygen tank the gas passes via a valve to a water bottle and then into an apparatus resembling that used in pneumothorax. The displacement of the water in the bottle measures the exact amount of oxygen administered. A manometer is also set in the system to indicate the pressure under which the gas is being administered (Fig. 2).

The femoral artery is punctured with a small-gauge needle. The apparatus is connected with a pressure setting equal to the systolic blood pressure. This allows the gas to be administered during the diastolic phase only. Within ten to fifteen seconds, 50 to 150 cc. of oxygen is allowed to enter the artery. The exact time required for the oxygen administration is noted by observing two factors: (1) the fluctuation of the water column synchronous with pulsation, and (2) the rhythmic blowing

Fig. 2.—A commercial adaptation of the Möller apparatus, manufactured by the Draeger Company (Germany).

sound at the site of the puncture. The rate of oxygen insufflation varies proportionately to the gauge of the needle and the ratio of the systolic to the diastolic pressure.

Soon after the injection the patient's skin becomes pale and then pink. The erythema sometimes extends to the umbilicus. One need not be alarmed if the peripheral pulse of the lower extremity disappears temporarily since oxygen is compressible and will not transmit the pulse wave. Within a few minutes the pulse, if present before the procedure, will return, and the extremity will be warm and dry.

It was possible to evaluate the condition and the course of the arteries by location of the cramplike pain and the course of the prickling sensation descending in the extremity.

We shall now list some of the symptoms observed by different patients, which are characteristic of their specific pathologic conditions:

Fig. 3.—Arteriopneumogram showing the femoral artery on the right and the posterior tibial on the left. One can see the bifurcation of the anterior and posterior tibial arteries.

1. If the oxygen goes directly to the toes via the femoral, popliteal and tibialis arteries, the patient immediately notices a prickling sensation all the way to the toes.

2. If the prickling sensation is confined to the posterior aspect of the thigh, the femoral artery is probably occluded and the gas is flowing via the femora profunda artery. The patient also usually feels pain at the site of occlusion, owing to dilatation of the artery proximal to the occlusion. Arteriopneumographic study demonstrates the occlusion if exposure is made at this time.

Oxygen Tissue Therapy: We have also used oxygen subcutaneously and intramuscularly as aforementioned, in this way bringing the gas directly to the affected area. Oxygen (200 to 300 cc.) was infiltrated into the extremity in such a way that it was distributed over the calf and foot. This procedure causes no pain to the patient, and it is simple to perform. In many cases of peripheral vascular disease we have had good results when subcutaneous oxygen was used alone and better results when it was used in connection with intra-arterial oxygen therapy. We have noted that subcutaneous oxygen therapy gives excellent results in patients with superficial gangrene. This method appears to be completely harmless; no complications occurred in over 300 patients. The same technic as is employed in intra-arterial injection is applied, with precautions taken to make sure that one has not entered a vessel, in order to prevent embolism. As the gas is injected one can follow its course, which is usually that of the larger veins. At first it appears as if the veins are swelling, but this is only the gas following the course of the fascial planes around the veins. In addition to a prickling sensation during this injection, the patient notices a warm sensation in the extremity, which lasts for a relatively long time. Objectively, erythema follows pallor.

Arteriopneumographic Study. — Roentgenograms taken simultaneously with the therapeutic intra-arterial oxygen injection clearly point out any alterations and occlusions of the main artery. This eliminates the need of contrast studies in some cases. Arteriopneumographic study, however, does not reveal any information with regard to the collateral vessels or the retrograde flow in the veins (Fig. 3).

Results. — Our results are based on 4,000 intra-arterial oxygen injections in 235 patients. Most of these patients were followed for one to four years. The types and stages of the diseases treated are listed in Table 1. Whenever necessary, the oxygen therapy was repeated.

Occasionally the differential diagnosis between arteriosclerotic disease and thromboangiitis obliterans could not be made because the arteriogram and clinical data were indecisive. The age of 45 years is our criterion for tentative classification.

The 8 patients with Raynaud's disease treated by this method refused thoracoscopic sympathectomy. Oxygen was administered subcutaneously to these patients.

In patients with acute arterial embolism, embolectomy was performed first and oxygen therapy used postoperatively.

Frostbite is best treated by sympathetic nerve block, and only for patients with residual symptoms or persistent ulcers was subcutaneous oxygen therapy used.

The severity of disease in the 235 patients was variable, especially in those with arteriosclerosis who ranged from the symptomatic stage only to the stage in which there were large areas of gangrene requiring amputation. In those patients who had far advanced disease we observed no improvement from the oxygen therapy. If the area of gangrene was small, however, improvement and often complete recovery were achieved by this method. In 29 patients with early peripheral disease we accomplished complete recovery in 20 (69 per cent) with intra-arterial oxygen. The walking tolerance of these patients was unlimited upon recovery (Tables 2 and 3).

TABLE 1.—*Diseases Treated*

1. Degenerative vascular disease (arteriosclerosis, arteriosclerosis of diabetes)	134
2. Thromboangiitis obliterans (Buerger's disease)	81
3. Raynaud's disease	8
4. Postembolectomy for residual symptoms	20
5. Frostbite residual	12

TABLE 2.—*Completed Figures on All Cases*

	Cases	*Complete*	*Improved*	*No Improvement*
Far advanced peripheral vascular disease with ulceration or gangrene	39	3	14	22
Moderately advanced peripheral disease with absence of lower arterial pulse and intermittent claudication	187	26	122	39
Early peripheral vascular disease with intermittent claudication	29	20	9	0

TABLE 3.—*Breakdown of Table 2 according to specific diseases*

	Cases	*Complete*	*Improved*	*No Improvement*
Arteriosclerosis, diabetic arteriosclerosis	134	28	63	43
Thromboangiitis obliterans (Buerger's disease)	81	14	56	11
Raynaud's disease	8	1	6	1
Residual postembolectomy	20	4	10	6
Frostbite residual	12	2	10	0

SUMMARY

1. Four thousand intra-arterial oxygen injections given to 235 patients, with only 1 complication.

2. Symptomatic relief from the intra-arterial injection of oxygen was obtained in about 74 per cent of the patients.

3. Arterial pneumographic study was incidental and often demonstrated the point of occlusion.

4. Capillary vasodilatation was demonstrated photomicrograpically.

5. Intramuscular or subcutaneous oxygen therapy was a useful adjunct to the treatment of superficial gangrenous areas.

6. The cost of the apparatus is reasonable, and the technic is free of complications.

ZUSAMMENFASSUNG

1. Es wurden an 235 Kranken 4000 intraarterielle Sauerstoffeinspritzungen mit Auftreten von nur einer einzigen Komplikation ausgeführt.

2. In etwa 74 Prozent der Fälle führte die intraarterielle Sauerstoffeinspritzung zu symptomatischer Erleichterung.

3. Gelegentlich liessen sich pneumographische Untersuchungen der Arterien anstellen, wobei es oft möglich war, die Stelle der Gefässverstopfung nachzuweisen.

4. Kapilläre Gefässerweiterung wurde photomikrographisch dargestellt.

5. Intramuskuläre und subkutane Sauerstoffbehandlung erwies sich als ein nützliches Hilfsmittel zur Behandlung oberflächlicher Gangrän.

6. Die Kosten des Apparats sind mässig, und die Technik bietet keine Komplikationen.

RIASSUNTO

1. In 235 malati furono eseguite 4000 iniezioni intraarteriose di ossigeno con una sola complicazione.

2. Nel 74% dei casi si ottenne un miglioramento dei disturbi.

3. Venne eseguito qualche studio arteriopneumografico e spesso fu possible mettere in evidenza la sede dell'occlusione.

4. La vasodilatazione capillare fu dimostrata con la fotomicrografia.

5. L'ossigeno intraarterioso o sottocutaneo è un ottimo ausilio terapeutico nella cura delle gangrene superficiali.

6. Il costo dell'apparato per la somministrazione è modesto e la tecnica è semplice e sicura.

RÉSUMÉ

1. 4,000 injections intra-artérielles d'oxygen sont faites à 235 patients avec une seule complication.

2. Presque 74 pour cent des malades ainsi traités ont éprouvé un soulagement symptomatique de l'injection intra-artérielle d'oxygen.

3. Un examen pneumographique des artères était fait par incident qui souvent a démontré le point d'occlusion.

4. On a pu démontrer par la photomicrographie une vasodilatation capillaire.

5. L'administration intramusculaire ou sous-cutanée d'oxygen a été un bon supplément au traitement des régions superficielles gangreneuses.

6. Le coût de l'appareil est raisonable et la technique d'administration est dépourvue de complications.

SUMÁRIO

1. Foram feitas 4.000 injeções intra-arteriais de oxigenio em 235 pacientes, com apenas 1 complicação.

2. O alivio simtomatico com a injeção intra-arterial de oxigenio foi obtido em cerca de 74 por cento dos pacientes.

3. O estudo pneimografico arterial foi acidental e frequentemente demonstriu o ponto de oclusão.

4. A vasodilatação capilar foi demonstrada microfotograficamte.

5. O emprego do oxigenio subcutaneo ou intramuscular constituiu adjunto util no tratamento de areas gangrenosas superficiais.

6. O custo do aparelho é rasoavel e a tecnica se apresenta livre de complicações.

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EVERY ISSUE A "SPECIAL" ISSUE

In recognition and appreciation of the fine work so well begun and so admirably continued by the various Specialty Sections within the College, the *Journal of the International College of Surgeons* begins the year 1956 in a new form, that of categorical presentation of original scientific articles. For a full explanation of the converging factors that made this innovation both necessary and desirable, see *Comments by the Founder,* Bulletin Page 3.

I. Experimental Surgical Approach to the Aortic Valve in the Dog

ALDO PARENTELA, M.D., ENZO DE CESARE, M.D.
AND
FERDINANDO LANNUTTI, M.D.
ROME, ITALY

THE importance of developing a method of surgical treatment of aortic stenosis cannot be overemphasized, because acquired aortic stenosis, resulting from rheumatic heart disease, is the second most common acquired stenotic valvular deformity.

Tuffier is credited with the first clinical attempt to relieve aortic stenosis (1913), but little consideration was given to the investigation of this problem until the work of Smithy and Parker again focused attention upon it.

Many reasons make surgical care of the aortic valvular disease very difficult: both the ventricular and the aortic routes are hazardous because of conditions peculiar to the tissues traversed. The ventricle tends to fibrillate with surgical trauma, and, in addition, as with aortic stenosis the intraventricular pressure is very high, the hypertrophied myocardium may be unable to hold closing sutures. It is also very hard to mobilize the ascending portion of the aorta, especially because of the pulmonary artery, which resists separation and is so tenaciously adherent to the aorta itself that inadvertent damage to both vessels must be anticipated. Anatomically, in addition, the ascending aorta forbids easy approach and often proves friable, so that the smallest incision may sometimes cause fracture of its wall.

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Many reports have appeared in the literature pertaining to methods of surgical approach to the aortic valve. Some of them have been applied to man; others must be considered an experimental expression of the interest evoked by the problem in many authors. Pearl and his associates have recently summarized these reports.

We conducted the present research after we read the paper by Satinsky and his associates on the experimental transplantation of the complete arch of the aorta, in which the authors suggested a procedure they said was not difficult. We found this procedure logical and reasonable, and we thought that it could be applied safely and satisfactorily to the treatment of stenosis of the aortic valve.

Experimental Methods and Results. — Experiments were then made, both at normal blood pressure and with the aid of hypotension, in 10 healthy mongrel dogs under nembutal anesthesia. The left side of the chest was entered through the fifth interspace, respiration being maintained by means of continuous hand control by the anesthetist.

The pericardium was incised parallel to the phrenic nerve, from above the aortic arch to the apex of the heart; retention sutures of No. 3-0 silk were placed to retract the pericardium itself, and were anchored along the sternal edge of the incision. The ascending portion of the aorta was dissected out and stripped of fat and

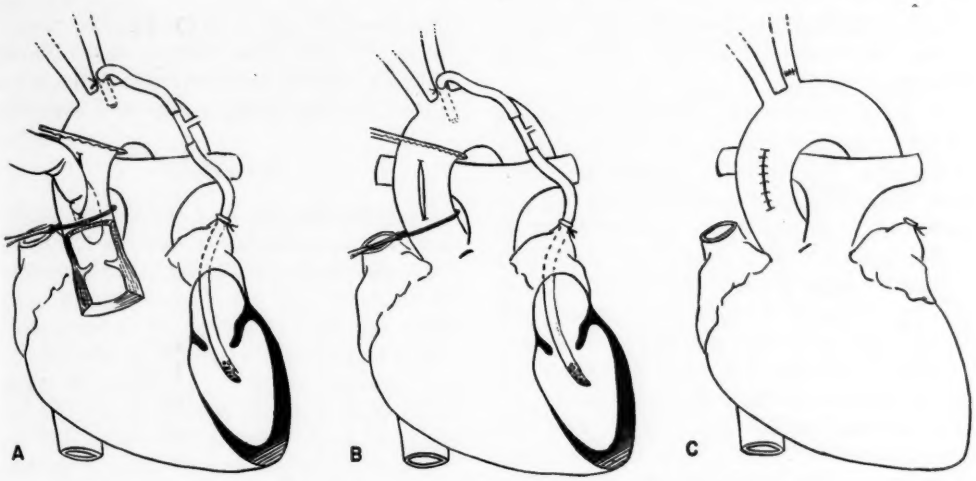

Fig. 1.—Schematic drawing of operative technic (see text).

pericardium, particular attention being paid to the pulmonary artery. A purse-string suture was placed around the left auricular appendage, which was then clamped and incised. The large-bored end of an unlined polyethylene tube was passed down through the mitral valve into the left ventricle; immediately thereafter the purse-string suture was tightened. The ventricular end of the tube was tapered and had multiple perforations to minimize the possibility of complete occlusion by apposition of the ventricular walls.

Another unlined polyethylene tube was introduced into the aortic arch through the left brachiocephalic artery and connected with the one in the left ventricle by means of a siliconized T-shaped glass tube, the purpose of which was to prevent air embolization; by-passing of the aortic valve was then obtained, not very differently from that described in 1910 by Carrel and, more recently, by Clatworthy and Varco (1950), Shaffer and Hardin (1952), Hubay and his colleagues (1952), Cross and his co-workers (1954) and Satinsky and his collaborators (1955).

This by-pass was not complete, of course, but the tube in the heart permitted some flow of blood through the incompletely obstructed mitral orifice for left ventricular filling, and also provided the left ventricle with an outlet, although a valveless one. The coronaries were supplied by blood passing from the left ventricle through the aortic valve.

The aorta was then clamped with a Crafoord clamp proximal to the right brachiocephalic artery, and an unrolled square of surgical gauze was wrapped around it, as near as possible to the valvular plane but distal to the coronaries, to provide circumferential constriction, with the aid of a modified Rumel-Belmont tourniquet, around the operating finger during the intra-aortic stage of the procedure (see illustration, *A*).

During this time the cerebral blood flow was maintained through the by-passing tube, which could also provide blood satisfactorily to the general body flow, according to the well-known fact that the body will tolerate a reduction of the cardiac output down to 50 per cent per minute of the

original amount, and that the vital organs below the neck can tolerate rather long periods of anoxia.

A 4 cm. longitudinal incision was then made on the anterior aspect of the ascending aorta, between the Crafoord clamp and the modified Rumel-Belmont tourniquet: an ungloved finger was introduced, and the tourniquet itself was tightened around it (see illustration, *B*); the finger tip was advanced cautiously toward the aortic valve. In the whole series it was possible to palpate this valve and enter the left ventricle: there was slight leak from the incision on the aortic wall, but this was ignored unless the amount of leakage was large. Only 2 dogs died during this procedure from rupture of the aortic wall. In all the other instances we first applied two stitches of No. 2-0 silk 4 cm. apart and then made the incision on the aortic wall between them; by this means we could always perform the intra-aortic stage of the operation satisfactorily and safely.

After completion of this maneuver the finger was drawn out and the incision on the aortic wall repaired. We used a continuous mattress suture in No. 4-0 silk on curved atraumatic needles, reinforced by suturing a strip of free pericardium over it.

The Crafoord clamp and the modified Rumel-Belmont tourniquet were then released, and the by-passing tube was withdrawn from the left auricular appendage and from the left brachiocephalic artery, which were sutured; in 3 cases it was possible to perform an end-to-end anastomosis of the divided brachiocephalic artery (see illustration, *C*).

All dogs survived except 2, which died during the operation from unmanageable induced hemorrhage. Ten dogs were then operated upon, after hypotension had been induced by means of pendiomid (Ciba), injected intravenously. The average systolic blood pressure was about 100 mm. of mercury. The same technic was followed as has been described. All the animals tolerated the operation easily and survived.

CONCLUSIONS

We should like to conclude by saying that, ideally, stenotic disease of the aortic valve should be treated by operation under direct vision in the open heart in a dry field; this type of procedure is being done, but it has not yet advanced to the point of practicality. Until it has been adequately developed, artificial devices that afford the surgeon some help in his work will continue to be of some interest and perhaps of some use.

The procedure we have described, especially with the aid of hypotension, is in our opinion logical and reasonable, and there seems to be no good reason why it should not be fully available to clinical application in human patients.

SUMMARY

The authors describe an experimental procedure for approaching the aortic valve, which they applied alone in 10 dogs and in 10 other dogs with the aid of previously induced hypotension.

Author's Note: My chief, Professor Raffaele Paolucci di Valmaggiore, watched the progress of this investigation with the keenest interest. I am deeply indebted to him for his kind support, his sound advice and his constant encouragement. It is a pleasure to record my grateful acknowledgments to Associate Professor Giuseppe Bendandi. In the planning and execution of this investigation his enthusiasm, stimulating comments and valuable criticism have been of incalculable benefit. I am indebted also to Dr. Enzo de Cesare and to Dr. Ferdinando Lannutti, whose expert help considerably facilitated the surgical work. Grateful acknowledgment is also due to C. V. Heljestrand Co.—A. B., Eskilstuna, Sweden, whose experimental department manufactured the instrument.

ZUSAMMENFASSUNG

Es wird ein experimenteller Zugangsweg zur Aortenklappe beschrieben, der an zehn

Hunden und an zehn weiteren, bei denen vorher eine Herabsetzung des Blutdruckes ausgeführt worden war, angewandt wurde.

RIASSUNTO

L'autore descrive un metodo di accesso alla valvola aortica che egli ha usato nei cani, 10 volte in condizioni normali e 10 volte in ipotensione.

RÉSUMÉ

Les auteurs décrivent une procédure expérimentelle pour l'opération à la valve aortique qu'ils ont appliqué à 10chiens a l'aide d'hypotension artificielle préoperative.

SUMÁRIO

Os AA. descrevem um metodo experimental para acesso à valvula aortica, metodo este aplicado isoladamente em 10 cães e em outros 10 cães com o auxilio de hipotensão previamente induzida.

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At heart, we all believe in the Healing Touch. It is no mere sentimental phrase but a powerful reality. We may not possess this gift, but we have certainly experienced it at the hands of others. How are we to define it? Something nearer magic than we are likely to admit. A sort of magnetic force in the personality which puts fear at rest, releases the restless currents of our being and harmonizes them in a new direction. Some people have it, the majority do not. This powerful human faculty is felt—in ordinary affairs, in politics, in business. But its most natural place is in the ancient art of healing, and in the medicine and surgery that have grown therefrom.

—Williams

II. Further Experience in the Surgical Repair of Experimentally Produced Atrial Septal Defects

Use of a New Instrument

ALDO PARENTELA, M.D.

ROME, ITALY

IN recent years considerable attention has been paid to the problem of atrial septal defects, and much effort has been directed toward the development of clinically acceptable methods for their closure.

In 1947, Cohn first demonstrated the experimental closure of artificially produced atrial defects by invaginating and suturing a portion of the right atrial wall to the edges of the defect: the stalk formed by this procedure was then severed and the defect in the atrial wall repaired.

Since then several technics have been proposed: blind or intracardiac tactile methods were described by Murray (1948); Swan and his associates (1950); Santy and his associates (1950); Hufnagel and Gillespie (1951); Kiriluk and his associates (1951); Martin and Essex (1951); Bailey and his associates (1952); Husfeldt and Sondergaard (1952); Björk and Crafoord (1953); Schumacher (1953); Gross and his associates (1953), and Gerbode (1953).

Hypothermia (Lewis and others, 1953 and 1954; Swan and others, 1953; Bailey and others, 1954) alone or combined with extracorporal circulation, has been used in the attempt to repair atrial septal defects by open methods. Until some technical and physiologic problems in the use of both hypothermia and extracorporal circulation are solved, however, it is necessary to apply one of the closed methods.

I intend, therefore, to report further results obtained by the use of a new in-

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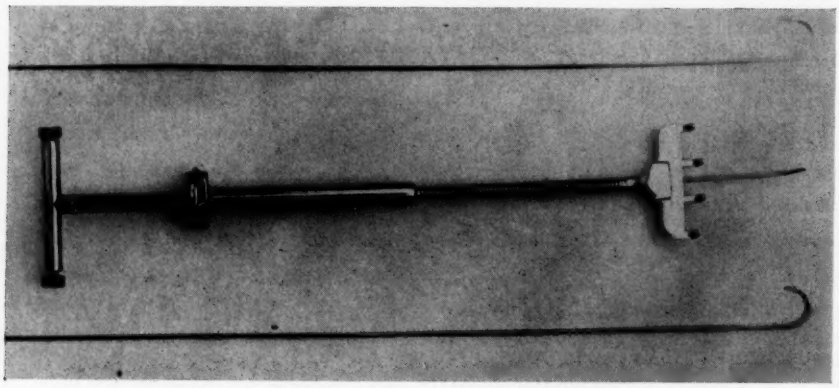

Fig. 1.—Instrument used by author (see text).

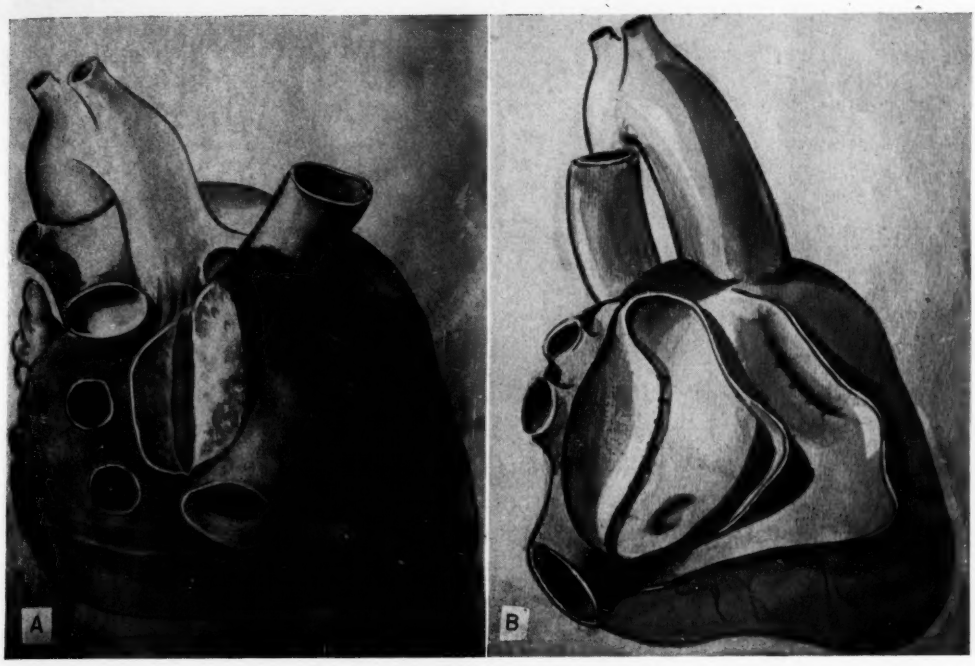

Fig. 2.—Operative technic (see text).

strument that I have described in previous papers and successively improved in the attempt to increase its efficacy, effecting the closure of large experimentally produced atrial septal defects in the dog.

The instrument consists of several parts (Fig. 1). The first is a small hook in stainless steel, whose top is provided with a T-shaped handle and which can glide into a flexible metallic sheath, remaining automatically fixed in the desired position. The sheath is provided at the inferior end with four small equidistant right-angled metallic wings. In the horizontal part of the T-shaped handle of the hook there are two small holes, one at each extremity, each provided with a small fixing screw. Finally, two other long, flexible hooks in stainless steel are available, which can be fixed to the instrument by passing them through the two small holes in the T-shaped handle of the central hook.

I have tried this instrument on 6 dogs in which large atrial septal defects had been created, applying the following operative technic. Under nembutal anesthesia the right side of the chest was entered through the bed of the sixth rib. The pericardial sac was opened wide in front of the phrenic nerve. Both superior and inferior venae cavae were clamped to interrupt the blood flow into the heart, and the wall of the right atrium was opened by an incision. The defect was created by cutting a piece of the septum that lies just at the bottom of the operative field. The atrial wall was then clamped, and a continuous suture was performed.

In the whole series, an attempt was made in each instance to create an atrial septal defect of the largest size, in which virtually no septal tissue remained; in some instances a septal rim was left. The intracardiac procedure, performed under

Fig. 3.—Further step in technic (see text).

direct vision, was completed in less than two minutes, most of the animals tolerated it satisfactorily, and ventricular fibrillation did not occur, as the caval clamps were released gradually; air embolization was not observed, as the heart had been filled with sodium chloride prior to release of the caval clamps.

The operative technic applied with the intent of repairing the septal defects was as follows. A groove was dissected between the two atria, starting between the superior vena cava and the right superior pulmonary vein (Fig. 2*A*), until the crossing of the muscular bundles from one auricle to the other was seen (Hanlon and Blalock, 1948; Sondergaard, 1952; Björk and Crafoord, 1953). The dissection was continued down to the inferior vena cava, with an effort to utilize as much groove as possible. The importance of this in the prevention of obstruction of the venae cavae or the pulmonary veins, once the suture is tied, has been pointed out by Björk and his associates (1954).

Once the groove was dissected, the forefinger of the left hand was introduced through the right auricular appendage to palpate the defect and the two atria. Guided by that finger, the hook was then introduced into the middle of the groove, down to the septal rim or to the upper border of the interventricular septum, which was picked up. The danger of damaging the coronary sinus or the bundle of His was very slight (Fig. 2*B*).

Immediately after the hook had been placed, the bottom of the groove was pushed down by means of the right-angled wings, and the whole instrument was fixed as soon as the atrial wall had become adherent to the septal rim (Fig. 3). A suture with three or four interrupted stitches in silk ethicon, No. 00, was performed: in most cases this was sufficient to obtain a satisfactory closure of the defect.

In 2 instances of very large defects, the forefinger introduced into the right atrium could feel, once the instrument had been fixed, that the adhesion between the atrial wall and the septal rim was not complete, particularly at the extremities. In these cases, then, one or both the supplementary hooks could be used. These were inserted through the groove, guided by the finger in the right atrium to pick up the nonadherent parts of the septum, and fixed in the T-shaped handle of the instrument. With their aid it was always possible to obtain perfect adhesion between the two parts to be sutured together. The suture could be performed easily and with highly satisfactory results. The instrument was then released and the hook, or hooks, were taken out. The forefinger of the left hand was drawn out, and the incision on the auricular appendage was repaired by continuous suture.

In 3 other dogs atrial septal defects were made by the technic described by Blalock; in these experiments, removal of the floor of the common terminal of the right anterior and cardiac pulmonary veins created a situation similar to that of atrial septal defects complicated by anomalous pulmonary venous drainage. Such defects were also closed satisfactorily by use of the aforedescribed instrument: the only difference in technic was that the in-

strument itself had to be applied, without dissection of any groove on the wall of the right atrium, just at the base of the pulmonary veins.

Since the results obtained in both groups of experiments were satisfactory, I should like to point out that the modifications I added to the technic first described by Gerbode — pushing down the atrial wall instead of picking up the septum, and the use of the new instrument aforedescribed—permit very good closure of atrial septal defects produced experimentally in the dog, even if there is abnormal venous return.

It is very important that no residual defect remain in the septum close to the valvular plane, where even a small opening would probably (Björk and others) cause a considerable shunt.

RÉSUMÉ

Cet article est une continuation d'un autre déjà publié dans ce journal sous le titre "Experimental Surgical Approach To The Aortic Valve In The Dog."

L'auteur fait ses expériments sur des chiens et il constate que les résultats dans les deux groupes ont été satisfaisants.

RIASSUNTO

Questo articolo è una continuazione di un precedente lavoro dello stesso autore sull'accesso sperimentale alla valvola aortica nel cane. I risultati delle esperienze sono stati soddisfacenti anche nel secondo gruppo di cani. Viene descritta la tecnica.

SUMÁRIO

Este artigo é continuição dox precedente, "Acesso cirurgico experimental à valvula aortica no cão," pelo mesmo outor. Novamente foram usados cães como animais de experimentação. Os resultados em dois grupos de animais foram satisfatorios. O Autor descreve sua tecnica.

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He [Brown-Séquard] was no longer an amateur researcher; he was now an experienced worker in physiology, burning to make discoveries, as fanatically devoted to his biological experiments as a priest to his devotions.

He tried experiments to revive the dead. The cadaver of a murderer who had suffered by Dr. Guillotin's efficient invention, was brought to the laboratory, and Brown-Séquard injected into the veins fresh blood from his own arm. Within three-quarters of an hour the phenomena of life seemed to return to the dead body. Muscles flickered and certain tissues showed signs of vitality, proving that when we die, all the organs do not die at once, but that some remain alive for hours and perhaps longer. Even death, it seemed, was not so simple a process as had been believed. What a theme for physiology, to revive the dead, to bring back movement and function to living things by reversing the apparently irreversible processes of decay. The corpse of the murderer lay still, but the light of life flickered in Brown-Séquard's brain, and he was sure there were no limits to the achievements of the physiological method. He had shown certainly that the grim transition between life and nothingness was not an abrupt change as humans had always believed, but a series of small deaths, like lamps going out one by one. He could not arrest the process, though he could study it, and he concluded that before he might bring the dead back to life he must know more about the body when it was living. Brown-Séquard moved to another field and this idea of resuscitating the dead itself remained dead for nearly a hundred years, when Soviet scientists revived it, and carried experiments even further, but without yet reaching the final secret.

—*Williams*

Definitive Bracing in the Treatment of Cerebral Spastic Paralysis of the Extremities

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IN the treatment of spastic paralysis of the extremities the main objective in the use of braces is to prevent or correct deformity. This is in some contrast to the purpose of bracing in cases of the residual paralysis of poliomyelitis, in which braces are used chiefly for support in substitution for the paralyzed muscles, or for limiting joint function, as in the presence of foot drop. In the treatment of clinical types of cerebral palsy other than the cerebral spastic, particularly the athetoid, braces are used not only for support but for the direct control of coordinated joint movement and the elimination of involuntary motion.[1]

By far the most common deformity associated with the spastic extremity is pes equinus. The wearing of braces at night has become almost a routine practice of patients in this clinic, not only for prevention of equinus but for the stretching out of contractures of the achilles tendon and muscle sheath caused by spasticity of the gastrocnemius soleus group of muscles. Operations for the lengthening of contracted heel cords can often be avoided by early and persistent application of a foot brace at night. No amount of stretching of the heel cord by a therapist or a parent can compare in effectiveness to the stretching obtained by the wearing of a foot brace during the long hours the child spends in bed. Then again, any benefits obtained from manual stretching of the heel cord, or even from the wearing of a drop-foot brace during the day, are nullified when the child sleeps in the prone position at night, since this position forces the foot into further equinus and allows the heel cord to contract. Quite frequently after wearing the foot brace at night, the child with contracture of the heel cords due to spasticity of the calf muscles, will be able to discard the braces during the day.

The night brace used for this purpose, as suggested by Phelps,[2] consists of a properly fitted high-quarter shoe that laces above the ankles, to which is attached a single bar caliper with a well-padded leather cuff below the knee and a right angle ankle stop fixed to the sole of

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the shoe. The caliper bar is a stout round bar that can be bent with brace irons as the heel cord stretches out and the foot comes up into greater dorsiflexion. At intervals, as the foot comes up into further flexion, the slack can be taken up by simply bending the round caliper bar with irons. In the application of this brace, it is important that the shoe be put on first and laced snugly above the ankle, so that the heel will not slip when the caliper bar and cuff are fastened. The oxford type of shoe should not be used, because the heel will slip out when the bar is applied. It is suggested that the toe-cap of the shoe be removed to insure that the toes, which may be under the influence of spastic flexor muscles, are not curled up under the foot. The foot brace is worn every night until full longitudinal growth of the tibia has taken place (usually at about the age of 16), because, as long as the tibia continues to grow in length, contracture of the heel cord may recur, since it is growth that creates a bowstring action in the gastrocnemius-soleus muscle and its motor arm, the achilles tendon. In the presence of varus deformity associated with equinus the caliper bar is applied on the medial aspect of the shoe, and an outside or lateral T strap is attached. This strap passes over the bar and pulls the foot toward the bar, correcting the varus deformity. If there are severe equinovarus deformities of the foot the varus deformity should be corrected first, as in the correction of clubfoot before one undertakes to obtain dorsiflexion of the foot by stretching the heel cord. The majority of equinus deformities, however, is associated with valgus. In this instance the caliper bar is placed on the lateral aspect of the shoe, and the T strap is fixed to the medial aspect. The results obtained with this type of treatment of equinus deformity associated with spastic paralysis of the foot have been most impressive in the correction of current deformity and equally decisive in the prevention of fixed equinus deformity. This simple night brace has precluded many operations for lengthening the heel cord. In addition, it has been my impression that, by persistent stretching of the heel cord with this brace, excessive shortening of the affected leg can be avoided through elimination of the bowstring action of the achilles tendon during the more rapid longitudinal growth of the tibia.

This brace can be recommended, too, for postoperative use after surgical lengthening of the heel cord.[3] It is a necessary safeguard, because the spasticity of these muscles is not diminished through lengthening the attached tendon, and recurrence of the contracture is therefore frequent. It can be avoided by the postoperative application of this simple foot brace at night.

Occasionally, contracture of the heel cord, due to marked spasticity of the gastrocnemius muscle (rather than the soleus), which resists correction by the short leg brace, will require a long leg brace with a double caliper bar. This brace, which maintains the knee in full extension and the foot in dorsiflexion, is applied at night. For children who cannot tolerate full extension of the knee at night it is utilized as a day brace. The stand-up table is a valuable aid in making these braces more acceptable, both in school and at home. The child wearing long leg braces in full extension at the knees, is placed in the stand-up table, where he can work with his hands, read, or otherwise be comfortably occupied. It is obviously impossible for a child to sit comfortably for any length of time with the knees locked in full extension.

Overactivity of spastic gracilis muscles, resulting in knee flexion and adduction contractures, is corrected by the use of long leg braces and a spreader bar. The spreader bar may be attached either above

or below the knees, but the knees must be locked in full extension.

The treatment of adduction contractures of the legs requires careful application of braces. Before braces are prescribed, a precise analysis of the cause of the adduction contracture or the scissors gait is advisable. The scissors gait in the child with cerebral spastic paralysis is frequently due to spasticity of the adductor muscles. Careful testing of the muscles, however, will demonstrate in many instances that the scissors action is due to spasticity of the flexors and internal rotators of the hips. These muscles are very close in action, and, although the patient is able to stand easily with the legs abducted, any attempt to flex the hips will cause internal rotation of the legs at the hips. When the adduction contracture or scissors gait can be attributed solely to spasticity of the adductor muscles, long leg braces, with the knees in full extension and an adjustable spreader bar above them, as aforedescribed, may be utilized. On the other hand, when there is marked overactivity of the hip flexors and internal rotators, it becomes necessary to attach the long leg braces to a pelvic band. Ball-bearing hip joints are then used to neutralize the thrust of the scissors action. In general, for training a child to walk in the presence of scissors action or adduction contracture, long leg braces with a pelvic band are utilized. Occasionally, when the internal rotation is not too severe, the pelvic band may be omitted; in its place, a posterior rotator strap is attached to upright extensions on the lateral bars of the leg braces.

For patients with milder degrees of internal or external rotation of the legs, due not to spasticity of the rotator muscles of the hips but to imbalance of "zero" cerebral or weak antagonist muscles, elastic straps, or "twisters," may be used. These appliances are used only for gait training. They are attached to a canvas belt worn about the waist and are twisted about the legs, terminating in buckles on the shoes. It must be emphasized that "twisters" should not be used in the presence of spastic hip rotators, since the elasticity of the straps will initiate stretch reflexes in the spastic muscles and increase the overactivity of these muscles rather than help to correct the deformity. These straps, too, are contraindicated when there is a tendency toward flexion of the knees.

SUMMARY

1. In the treatment of cerebral spastic paralysis of the extremities, braces are recommended for the prevention and correction of deformity.

2. The most frequent deformity associated with the spastic extremity is pes equinus, due to contracture of the achilles tendon.

3. A foot brace, worn at night, is recommended to stretch the contracted heel cord and to prevent deformity of the foot. This brace consists of a shoe, laced above the ankle, to which is attached a single round bar with a cuff below the knee joint, and a right-angled posterior ankle stop. This brace is recommended for postoperative use after surgical lengthening of the heel cord.

4. Definitive bracing for the overactivity of spastic gracilis muscles, adductor muscles, and flexor-internal rotator muscles of the hips is described. The rationale for this bracing is based on a careful analysis of the muscles involved in the production of the motor imbalance or the contracture.

RÉSUMÉ

1. Dans le traitement de la paralyse des extrémités on recommande l'application des freins pour prévenir et corriger une déformité.

2. La déformité qu'on le plus fréquemment associe avec l'extrémité spastique est

le pes equinus par conséquence d'une contracture du tendon d'Achille.

3. Un frein fort qui serait porté pendant la nuit est recommandé pour étendre la chorde contractée du talon et pour prévenir une déformité du pied. Cet appareil se compose d'un soulier, lacé au dessus de l'articulation du pied, auquel un seule tige ronde est attachée avec une manchette en dessous du genou et un arrêt rectangulaire posterieur du talon. Cet appareil est recommandé pour usage apres l'allongement chirurgical de la chorde du talon.

4. Un frein définitif est décrite contre la superactivité du gracilis, des muscles adducteurs et des flexeurs—internal rotateurs de la hanche. La raison de ce frein est basée sur une analyse exacte des muscles qui prennent part au dérangement de l'équilibre motorique ou à la contracture.

ZUSAMMENFASSUNG

1. In der Behandlung zerebraler spastischer Lähmungen der Gliedmassen werden Schienen zur Verhütung und Verbesserung von Entstellungen empfohlen.

2. Die häufigste durch spastische Lähmung einer Extremität entstehende Entstellung ist der Klumpfuss als Folge einer Kontraktur der Achillessehne.

3. Zur Streckung der kontrahierten Sehne und zur Vorbeugung einer Entstellung des Fusses wird eine während der Nacht zu tragende Fusschiene empfohlen. Diese besteht aus einem oberhalb des Fussgelenks geschnürten Schuhs, an dem eine einzige runde Stange mit einer Manchette unterhalb des Kniegelenks befestigt ist, und der mit einer rechtwinkligen das Fussgelenk fixierenden Schiene an der Hinterfläche versehen ist. Dieser Apparat wird zur Anwendung im Anschluss an die chirurgische Verlängerung der Sehne empfohlen.

4. Bestimmte Schienen zur Behandlung der Überaktivität des spastischen M. gracilis, spastischer Adduktoren und spastischer Beuger und Innenrotatoren der Hüfte werden beschrieben. Die Überlegungen, die solchen Schienungen zugrunde liegen, beruhen auf einem sorgfältigen Studium der Muskeln und ihres Anteils am Zustandekommen motorischer Instabilität oder von Kontrakturen.

RIASSUNTO

1. Nella cura della paralisi cerebrale spastica delle estremità viene raccomandato l'uso delle calzature ortopediche per prevenire e correggere le deformità.

2. La deformità più frequente a riscontrarsi è il piede equino, che è dovuto alla contrattura del tendine di Achille.

3. La calzatura ortopedica, indossata durante la notte, mantiene in tensione il tendine e impedisce la deformià. Essa consiste in una scarpa allacciata alla caviglia, a cui è attaccata una sbarra che termina in una cuffia al di sotto del ginocchio. Essa può essere usata anche dopo gli interventi chirurgici correttivi.

4. Viene descritto anche un metodo per correggere lo spasmo del muscolo gracile, degli adduttori e dei flessori dell'anca. Esso è basato su uno studio accurato della attività dei vari muscoli interessati.

SUMÁRIO

1. No tratamento da paralisia cerebral espastica das extremidades, são recomendados suspensorios para a profilaxia e correção da deformidade.

2. A deformidade mais frequentmente associada à extremidade espastica é o pé equino, devido à contratura do tendão de Aquilles.

3. Um suspensorio para o pé, usado à noite, é recomendado, para distender o tendão de Aquilles e evitar a deformidade do pé. Tal suspensorio consiste em um sapato, amarrado acima do tornozelo, ao qual é amarrado uma barra unica arredondada com um manguito abaixo do joelho.

Este suspensorio é recomendado para uso pos-operatorio, após o alongamento cirurgico do tendão.

4. É descrita a conduta com relação à super-atividade dos musculos gracilis, adutores e rotadores flexores internos da articulação coxofemural, após analise cuidadosa dos musculos comprometidos na produção do desequilibrio motor ou da contratura.

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The fight for freedom is not to be won by any mere change in our economic system. It is to be won only by a constant resistance to the tyranny of officials, and a constant realization that mental freedom is the most precious of all goods. Mechanism has its place. Its place is in the material side of life, the provision of the food and clothes and houses without which we cannot live. But it has no place in what makes life worth preserving, in art and thought, in friendship and love, or in simple enjoyment.

The greatest possible amount of free development of individuals is, to my mind, the goal at which a social system ought to aim. To secure this end, we need a compromise between justice and freedom: justice, to secure opportunity and the necessaries of life for all; freedom as to the use made of opportunity, so long as that use does not infringe justice. Justice and freedom have different spheres; the sphere of justice is the external conditions of a good life; the sphere of freedom is the personal pursuit of happiness or whatever constitutes the individual's conception of well-being.

—*Russell*

Problems of Obstetrics and Gynecology in Relation to Infection of the Urinary Tract

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IN a paper of this kind there are many factors to be considered. It is rather difficult to emphasize the most important ones in the space available. Female urologic, gynecologic and obstetric conditions are so intimately related that there is no separating them logically in making a diagnosis.

Clinical observations have aroused the suspicion that infections of the urinary tract in mothers may be the source of infection in the newborn. This hypothesis was supported by observations made in an early study, in which it was reported that manipulation in the course of delivery seemed to have caused infection in the newborn. The diagnosis of infection of the urinary tract may be made by examination of smears prepared from sediments from the urine. Gram's method may be used for staining. The pathogenicity of the bacteria possibly involved varies greatly; it is mandatory, therefore, that some idea of the nature of these organisms be obtained.

Complications to be looked for are as follows:

1. Internal infection—infection in the respiratory or the gastrointestinal tract.
2. External infection—localized to the skin and also to the navel and the eyes.
3. General symptoms—including vomiting and elevation of temperature for no less than two days.

Some authors have stated that the frequency of infection is highest in the newborn[1] (mortality rate, 20 per cent).

In one of our recent cases the patient after about eight months pregnancy was delivered of twins. The membranes ruptured about six hours before the first baby was born. This was a head presentation, and delivery was accomplished without

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undue trouble. The second baby was born about thirty minutes after the first and was in a separate bag or sac. The membranes did not rupture until the baby was presenting to the surface of the vulva, and it was easily delivered by breech extraction. Both babies seemed normal until the second day, when the first baby, a girl who had weighed 4 pounds 11 ounces (2,626.2 Gm.) at birth, began to vomit and became jaundiced; fever set in, and she died less than forty-eight hours after birth. The second baby, a boy weighing 5 pounds 6 ounces (2482.5 Gm.) at birth, seemed perfectly well until the third day, when similar symptoms developed. He died within six hours after the onset of symptoms and less than sixty hours after birth. On blood culture from the two babies the same organism was grown, which was reported as Aerobacter aerogenes in an almost solid field. The particular point of interest in this case was the fact that the membranes of the first baby ruptured about six hours prematurely; the second baby was in a separate sac, and the membranes did not rupture until the breech was presenting at the vulva. The same organisms were grown in the two instances. It raised the question rather forcibly, whether intrauterine infection with this bacillus can occur. The mother had no symptoms and no trouble before or after delivery. I saw her in the office within an hour and half before the first membranes ruptured, and at that time she was feeling perfectly well.

Chronic urethritis is thought to be a factor contributing to infections related to pregnancy. Many authors of urologic textbooks do not even mention the existence of chronic urethritis, which is probably much more frequent than it is thought to be. Some authors state that urethritis in girls has been recognized as one of the most common causes of complaints referable to the urinary tract in pediatric urology.

The subjective and objective picture and the symptoms of urethritis are well known; urgency, dysuria, nocturia, and diurnal frequency of urination are the most characteristic complaints. Hematuria and obstructive symptoms are unusual but may occur.

In many cases of vaginal infection the secretions do not invade the urethra. The labia have varying degrees of irritation and redness, which frequently extend to the inner aspect of the thigh. Urine cultures may be sterile but they often contain the bacterial offenders ordinarily associated with infections of the urinary tract—especially Escherchia coli, Bacillus proteus, and beta hemolytic Staphylococcus aureus. Elimination of the pyuria should be done as quickly and as thoroughly as possible. Urethritis should be treated and vaginitis controlled not only in the gynecologic patient but as far as possible in the obstetric patient before delivery. This is frequently accomplished by the use of sulfonamide preparations or such antibiotics as aureomycin or terramycin. Penicillin or streptomycin is not necessary in every case.

Urethral dilation for urethritis initiated while the patient is under anesthesia for cystoscopic procedures, may aid greatly in clearing the urethritis.

As has been stated, control of vaginitis by local treatment is absolutely essential to the prevention of relapse and recurrence.[2]

The closely related embryonic and anatomic development of the urinary and genital organs is responsible for the reciprocal manifestations often exhibited between the two systems. The intimate anatomic relation between the genital apparatus and the lower part of the urinary tract predisposes to harmful effects in one when abnormal processes are present in the other.

1. Innervation of both systems is de-

rived from ganglia along the aortic and celiac plexuses, from the hypogastric nerve trunk and from the pelvic plexus.

2. The left ovarian vein empties into the left renal vein, and both ovarian veins have direct branches from the ureters.
3. The internal genitourinary organs (bladder, uterus, tubes and ovaries) drain into the lymph glands along the floor of the pelvis.

Pregnancy may have a marked effect upon the ureters and kidneys. Proper treatment for disease in one system may have a serious side-effect on the other.

Infection often initiates such symptoms as (1) steady pain in the lower part of the vagina and (2) dyspareunia. The classic symptoms of vesical inflammation — frequency, burning or pain on urination, and suprapubic pain — usually lead the physician to the proper diagnosis. Occasionally the atonic neurogenic bladder is encountered and mistakes in diagnoses are made and radical treatment carried out.

The "honeymoon bladder" is always to be thought of. Ectopic kidney should not be overlooked. The effects of pregnancy on the urinary system, as well as the marked changes that occur during pregnancy and the puerperium, are well known. It is estimated that over 80 per cent of pregnant women will show dilatation of the ureters, usually more marked on the right. The dextrorotation of the uterus would cause more pressure on the right ureter; the sigmoid colon would have a tendency to protect the left ureter.[3]

Although urologic indications for therapeutic abortion may exist, the genitourinary system, with the possible exception of the cardiovascular system, consists of the most vulnerable of all to the possible deleterious effects of pregnancy.

In the urologic assessment of the ability of a patient to undergo pregnancy, the following points are of major importance:

1. Albuminuria. If it is present, a quantitative determination should be made.
2. Concentration of urine. The specific gravity should be 1.025 or higher.
3. Intravenous pyelographic picture. This is important for visual detection of kinking, obstructions, recurrent tumors, etc.
4. Urea clearance. Less importance, probably, is placed on this than formerly.
5. Retrograde pyelographic and cystoscopic pictures. These studies are utilized when indicated, but should not be done routinely; however, there are very few complications associated with them if properly done.

Indications for therapeutic abortion are as follows:

1. Renal tuberculosis of any degree of activity.
2. Genitourinary malignant disease. The high incidence of recurrence plus the physiologic changes induced in the urinary tract by pregnancy makes continuation of the latter especially hazardous.
3. Congenital polycystic disease. The bilaterality of this condition usually contraindicates the added strain of pregnancy.
4. Hypertensive cardiovascular renal disease.
5. Chronic nephritis, in which permanent renal damage has been sustained as the result of acute infection. This should always be considered, for in some cases proper evaluation may enable the patient to go to term.[5]

No discussion of the relation of chronic cervicitis to infection of the urinary tract can ignore the treatment of existing granular urethritis and polypoid excrescences. Fulgeration, dilation, and silver nitrate

may relieve many patients of their symptoms. Clinical observation often suggests that in many instances the primary etiologic factor is some gynecologic disease. Sturmdorf and others have emphasized the importance of the cervix as a chronic focus of infection for systemic disease.

Chronic cervicitis near the base of the bladder is intimately connected to the anterior surface of the supravaginal portion of the cervix and to the area above as far as the internal os. This area is near the anterior portion of the base of the broad ligament or parametrium. In this area, between the peritoneum and the pelvic fascia, are incorporated the uteropubic ligament, an abundance of loose areolar connective tissue, smooth muscle fibers, a rich network of lymphatics and the blood supply. This is spoken of as the "weak spot."

White has fully demonstrated, experimentally, by injection of India ink as well as living and dead tubercle bacilli into the cervices of guinea pigs and rabbits, that a lymphatic connection exists not only between the bladder and the cervix but between the cervix and the vagina.

In experimental work, Maryan, after grinding, under aseptic technic, cervical tissue enucleated by Sturmforf's method of conization with the high frequency cutting current scalpel, isolated the heat-resistant enterococcus from the depths of the compound racemose glands in 80.4 per cent of the specimens.

Lesions of the cervix may be classified as follows:

1. Congenital erosion. This is encountered in virgins and young girls.
2. Ectropion or eversion of the cervical lips. This is not a true erosion but a bulging forward of the velvety red endocervical mucous membrane.
3. Simple erosion. This represents replacement of the stratified squamous epithelium of the cervical lips by high cylindric epithelium.
4. Follicular erosion which is characterized by the presence of retention cysts, the so-called Nabothian follicles or cysts.
5. Papillary erosion, manifested grossly by velvety red elevations on the surface of the cervical lips.
6. The healing of erosions, or replacement of the glandular misplaced epithelium with stratified squamous epithelium.

Such lesions as syphilis, tuberculosis, early carcinoma and pinpoint leukoplakia should be ruled out before coagulation. Coagulation should never be done in the presence of an acute or subacute inflammatory lesion of the internal or external organs.

Urinary infections are frequent and often serious complications of gynecologic and obstetric conditions. The etiologic agent may be any one of a variety of microorganisms, but in the majority of cases some member of the coliform group of bacilli is the responsible agent.

With regard to cure, the following suggestions are made:

1. Elimination of the source of infection from the bowel for three weeks may give the tissues of the urinary tract time to recover sufficient natural resistance to infection to protect them against recurrence.
2. The beneficial effect exerted by the sulfa drug upon the intestinal tract may decrease the avenues for escape of organisms into the blood stream or the lymphatic channels, through which they may have been reaching the urinary tract.
3. There may be certain strains of E. coli with a selective affinity for the urinary tract which are completely and permanently eradicated as a result of administration of the sulfa drug.[6]

Bacteria observed in the urine may represent an original invasion in the course of pregnancy or the quiescent stage of a previous infection. Primiparae are much more likely to become infected than are multiparae. It should be remembered that, although while these patients may become asymptomatic, it is not proof that the infection in the urinary tract has been eradicated.[7]

Stasis in the urinary tract during pregnancy favors the development of pyelonephritis. The most frequent locations for obstruction are (1) the ureteropelvic juncture, (2) the point of crossing of the ovarian vessels and (3) the pelvic brim. The ureteral wall shows effects of atony, dilatation, stasis and dilatability. There may be hypertrophy of Waldeyer's sheath; the terminal and intramural portions of the ureter may be displaced laterally. Periureteritis frequently occurs, causing matting of the loops and kinking. This follows infection, which may be confined to the mucosa and submucosa of the ureter and pelvis, but the sponginess of the walls permits extension through all layers.

The treatment is prophylactic and should be done during pregnancy. Careful inquiry as to symptoms referable to the urinary tract should be made at each antepartum visit. Trauma is most marked about the trigone and the adjacent bladder base. Rupture of the bladder usually occurs in the trigone. The bladder neck may be displaced from the symphysis; there may be urethral trauma and paraurethral lacerations. Catheterization by the clock is unreliable, for the bladder of one patient will fill much more rapidly than that of another.

An incarcerated uterus presses the cervix and adjacent anterior wall against the base and neck of the bladder.

Chronic pyelonephritis and hydronephrosis may develop. Factors modifying the pyelitis of pregnancy, with the cortex irregularly involved in pyelonephritis, are stasis allowing concentration of drugs and prolonged contact of drugs with tissues. Infection increases the degree of dilatation, and the time required for the appearance of dyes. Types of diseases are (1) parenchymatous, (2) pelvic and (3) combined.

In studying the urinary tract, the ureters in pregnancy might be studied in trimesters. The greatest atony is present from the fifth to the seventh month.

Renal tuberculosis and pregnancy—genitourinary tuberculosis—is adversely affected by pregnancy because of the impairment of drainage and the frequency of pyelonephritis due to pyogenic organisms.

The physiologic changes of pregnancy superimpose themselves on all the anomalies of position, number, form, blood supply and structure. Severe pyelonephritis almost invariably develops in polycystic kidneys during pregnancy. For this reason, physiologically speaking, pregnancy is rather a serious condition for a woman with polycystic kidneys.[8]

Chronic nonspecific urethritis is not completely understood. Any condition that reduces the resistance of the urethral mucosa to disease may initiate the pathologic changes that result in chronic urethritis. It is estimated that over 95 per cent of patients with this disease are married, which suggests that the trauma of intercourse is an etiologic factor.

Treatment of nonspecific urethritis involves three simple procedures: (1) irrigation and distention of the bladder with a bland antiseptic solution; (2) dilation of the urethra, and (3) instillation of silver nitrate solution into the urethra.

One author states that conservative treatment to the urethra, consisting of these three therapeutic measures, produced complete relief of dyspareunia in 13 patients and definite improvement in 10.[9]

It has been stated that the most frequent urologic complication of pregnancy is acute pyelonephritis. Some of the normal anatomic and physiologic changes that occur are looseness of structures in the urinary tract, with wide separations in the fibers of the muscular coats of the urinary organs; widening of the submucosal layers, and increased thickness of walls or channels out of proportion to the evidence of hyperplasia.

It has been stated that the second most important factor in the production of acute pyelonephritis is the pressure of the pregnant uterus against the brim of the pelvis. This pressure obstructs the outflow of urine from the upper channels.

The diagnosis is based on a history of chills, fever, sweats, pain in the renal area on one or both sides, fever and the presence of pus and bacteria in a catheterized bladder specimen.

The pyelonephritis of pregnancy is a preventable disease; therefore, prevention is of the greatest importance. All foci of infection should be removed, and proper bowel management must be instituted.[10]

The bladder, because of its position in the bony pelvis and its proximity to the enlarging uterus, is usually compressed in the anteroposterior diameter, and the cystic organs reveal the usual saddle-shaped deformity.

The clinical incidence of pyelonephritis in pregnancy is 1 to 3 per cent, according to various observers.[11]

In our discussion of the urologic aspects of gynecology during the past quarter of a century, much emphasis has been placed upon the desirability of training the gynecologist in the fundamental principles of obstetrics. It is no less important for the well-trained gynecologist to be grounded in the gynecologic and obstetric aspects of urology.[12]

Infection of the urinary tract is usually referred to as pyelitis. When renal infection appears during or after delivery, it is usually the result of renal stasis, apparently of the ascending type rather than the hematogenic. In former years the pyelitis of pregnancy was recognized by symptoms such as urinary frequency and dysuria or as malaise and fever. Pyelitis causes much concern, because it often remains undiscovered until extensive renal damage has taken place. If urinary infection is present, the physician, in order to administer proper treatment, should have at least a superficial knowledge of the invading bacteria. Such knowledge can be obtained easily by Gram's method of staining the dried urinary sediment. Whether the bacilli or cocci are gram-positive or gram-negative makes considerable difference in the type of treatment indicated. Infection with colon bacilli, when detected early, usually responds readily to chemotherapy.

If pyuria fails to clear up after treatment with forced fluids or chemotherapy, the presence of some complication must be suspected.[13]

In one group treated with aureomycin,[14] the antibiotic was provided as a powder in capsules, each containing 50 mg., and given by mouth. The most common complaint was of looseness of the bowels with frequent (2 to 4 daily), bulky, soft stools, but no true diarrhea. Some patients with cystitis complained of a disagreeable sensation as of something "drawing" or "squirming" in the pelvis.

In the last fifteen years rapid strides have been made in the field of chemotherapeutics and antibiotics, so that today much more aid can be offered to the patient suffering with urinary infection.[15]

Many chemical compounds have been used for the eradication of infections of the urinary tract.

1. The sulfonamide drugs are effective against a greater variety of organisms than are most others.

2. They are attended by fewer unpleasant side effects than are most of the antibiotics, especially those administered orally.
3. An antibiotic is likely to be entirely ineffective if used before the results of culture have been reported. Each of the antibiotics is completely ineffective against some of the organisms that cause urinary infection.
4. The sulfonamides are less costly than the other drugs available.

Some of the types of urinary tract infection are as follows:

1. Acute cystitis, the commonest form encountered in gynecologic patients. In a single attack or in several attacks at long intervals, it probably does not indicate organic urologic disease.
2. Frequently recurring attacks of acute cystitis or chronic cystitis. These should lead to complete urologic investigation.
3. Simple forms of urinary infection. These can usually be successfully treated by sulfonamide therapy. Antibiotic therapy should be reserved for the more complicated and serious infections or those that have proved resistant to sulfonamide therapy. Antibiotic therapy is likely to prove more effective if the antibiotic is selected by means of sensitivity tests performed on the offending organism in each individual case.[16]

An antibiotic treatment that is based solely on the identification of the bacteria is irrational, as experience shows that a bacterial strain may change its sensitivity. In a study made by Halkier and others it is stated that with every sensitivity test the bacteria have been classified simultaneously.

The authors state that there should be (1) no irrational treatment, i.e., no antibiotic therapy without a sensitivity test; (2) instigation of treatment at the optimal time, probably two days prior to operation, and (3) as little intraurethral interference as possible. They avoid use of the indwelling catheter when feasible.[17]

It is obvious that if infection is due to any of the coliform or other gram-negative bacilli, the use of penicillin is valueless and subjects the patient to the risk of sensitivity reactions, thus preventing its subsequent use. Bacterial resistance of "fastness" has become a serious problem since the new agent has been generally available.

Clinical differentiation between acute infection, chronic infection and chronic infection with acute exacerbation gives important evidence as to the probable value of chemotherapy. Generally, in the presence of pure gram-positive coccal forms, penicillin is the drug of choice; for mixed infections a combination is indicated.

Infections of the bladder should be classified as to acuteness or chronicity before chemotherapy is considered. A high percentage of these infections will reveal only gram-negative rods in the stained urinary sediment. Chronic infections, on the other hand, if uncomplicated, are generally due to bacteria which have developed resistance to a chemotherapeutic agent formerly used.

Tuberculosis of the urinary tract is still, in most instances, a surgical problem, and streptomycin is used only for selected types of infection or as an adjuvant measure, preoperatively or postoperatively.

There have been "pellagra-like" reactions to chloromycetin, with glossitis and stomatitis. Vitamin B complex should be administered concurrently until further explanation of this side reaction is obtained.[18]

1. Dilatation of one or both ureters is present in most pregnant women

and is most marked and most common on the right side.

2. The dilatation involves the abdominal portion of the ureter. It is greatest at about the seventh month and diminishes near term.
3. Marked tortuosity and apparent elongation of the ureter is a common observation during pregnancy.
4. Obstruction of the ureter, delays in excretion and decrease in the urinary system may occur even though there is no history of disease of the urinary tract prior to the current pregnancy.
5. Lateral displacement may occur, especially on the right side.
6. Changes in the urinary tract may occur but are usually asymptomatic.
7. Acute infection may become superimposed upon the urinary system, even though there is no history of disease of the urinary tract prior to the current pregnancy.
8. Involution occurs following delivery but is delayed if infection has been present.[19]

These conditions have been thought to be due largely to pressure from the pregnant uterus; a few have expressed the opinion that some other factor is involved.

Some authors have stated that the position of the fetus has no bearing upon the dilatation observed, owing to its frequent change of position. In their opinion, the trigone reveals definite hypertrophy of the muscle layers, associated with edema and increased vascularity.[20]

Streptomycin has a supposed specific action on certain organisms; it is contraindicated in pregnancy, however, because of possible injury to the auditory and vestibular nerves. It is necessary to find a compound that will cure urinary infection of E. coli in both acute and chronic infections and which will be sufficiently nontoxic to allow its use in the treatment of patients with impaired renal function, severe anemias, pregnancy, etc.[21]

In the discussion of major infections the fundamental lesions might be listed as: (1) obstruction; (2) tuberculosis; (3) tumor; (4) foreign body (especially calculi), and (5) fistula.[22]

Chronic pyelonephritis may cause few if any objective symptoms during the entire period of gestation, but it may flare up at any time in an acute attack. Cystoscopic drainage of the kidney by ureteral catheterization produces spectacular results in cases of ureteral obstruction, high temperature, chills, etc.

For years the problem of the toxemias of pregnancy has been rendered obscure by multiple classifications and confusing terminology. McCaffery and Hess expressed the opinion that these toxemias should be classified as vasculorenal disturbances marked by hypertension, albuminuria and edema, with gradual suppression of urine, and that they should all be regarded as the same pathologic entity.

There are four possible stages of toxemia: (1) the mild toxemia of early pregnancy, manifested by nausea and vomiting; (2) toxemia with mild hypertension and slight albuminuria; (3) so-called preeclamptic toxemia, with a little more hypertension, some albuminuria and some edema, and (4) the eclamptic or terminal stage, manifested by hypertension, scanty urine, massive albuminuria, edema and convulsions.[23]

Obstruction in the urinary tract is a most important cause of persistent or recurrent infection. It occurs in children and in women and may be treated by dilation with the use of sounds, or by endoscopic resection of fibrous or redundant tissue at the vesical neck.

Hydronephrosis is often caused by narrowing of the ureteropelvic juncture or by obstruction along the course of the ureter. Diagnosis is made by intravenous

urographic study, ureteral catheterization, and retrograde pyelographic study.[24]

In discussing urinary antiseptics, O'Connor stated that there are only two periods in medical treatment of infection of the urinary tract. He used the terms as "B.B.C." (before bacterial cultures) and "A.B.C." (after bacterial cultures). He stated that the first antiseptic of any real germicidal value was hexamethylenamine. Urotropin, uritone, etc., are among the many trade names given to methenamine. Several of the "wonder drugs" are sulfanilamide, penicillin, streptomycin, aureomycin, chloromycetin and terramycin.

Antibiotics derived from bacteria have important, although limited, uses in the treatment of urinary tract infections.[25]

In the beginning of the third trimester of pregnancy one usually observes the maximum degree of change in the upper part of the urinary tract. Cystoscopic observations of the ureteral orifices during pregnancy tend to confirm the idea of atonicity. Feeble spurts of urine, with only minor contractions of the ureteral orifices, can often be noted. Temporary hydroureter (upper two-thirds) and hydronephrosis are produced on either one or both sides, probably as the result of hormonal activity producing atonicity of the ureters and the renal pelvis, which is accentuated by the mechanical obstruction of an enlarged uterus.[26]

The urologic complications of pregnancy may be summarized thus:

1. Complications based on physiologic changes
   a. Atony of the urinary tract
   b. Cystitis
   c. Pyelitis
   d. Bacteriuria
2. Diseases complicated by pregnancy
   a. Acute nephritis
   b. Chronic nephritis
   c. Calculus
   d. Malformations
   e. Tuberculosis
3. Complications based on anatomic changes
   a. Ischuria due to incarceration of the retroverted pregnant uterus
   b. Dietl's crisis
   c. Vesicovaginal fistula.[27]

Pyeloureteritis and urinary stasis of greater or lesser degree are the usual accompaniments of pregnancy.

In the discussion of pyeloureteritis complicating pregnancy, too much emphasis has quite naturally been placed upon the acute or febrile phase of the disease. It is so much more obvious than the chronic and can frequently be diagnosed without the aid of laboratory or other special procedures, with the result that the chronic or afebrile phase has been neglected.[28]

SUMMARY AND CONCLUSIONS

1. Some knowledge of female urologic conditions is indispensable in making gynecologic and obstetric diagnosis. Embryologically the genitourinary and the genital system are intimately related.

2. Infections of the genital and genitourinary tracts frequently originate from the gastrointestinal tract. Gram's method for stains is beneficial in diagnosing infection of the urinary system.

3. Pyelitis, ureteral stricture and other infections of the urinary tract frequently cause bizarre abdominal pains or gas in the stomach and intestines.

4. Urine cultures may be sterile but often contain the bacterial offenders ordinarily associated with urinary infection, especially Escherichia coli, Bacillus proteus and beta hemolytic Staphylococcus aureus.

5. Many infections of the urinary tract can be controlled by sulfonamide preparations or antibiotics, such as aureomycin or terramycin. Penicillin or streptomycin is not necessary in every case.

6. Innervation of the genitourinary system is derived from ganglia along the aortic and celiac plexuses.

7. Proper evaluation of the extent and seriousness of the disease should be made before therapeutic abortion is advised.

8. Stasis in the urinary tract during pregnancy favors the development of pyelonephritis.

9. Renal tuberculosis, carcinoma of the urinary tract or polycystic renal disease usually contraindicates pregnancy.

10. The pyelonephritis of pregnancy is frequently preventable.

11. Great strides have been made in the past fifteen years in the use of chemotherapy and antibiotics for infections of the urinary tract.

12. A preliminary test of sensitivity is valuable.

13. Physiologic dilatation of the ureters during pregnancy may result in pathologic change. Dilatation is usually more marked on the right than on the left.

14. Obstetricians, gynecologists and urologists should work together as a team. If this is not practicable, obstetricians and gynecologists should know something of female urologic diseases.

RÉSUMÉ

1. Un certain degré d'expérience dans les conditions urologiques est indispensable dans la pratique gynécologique et obstétrique. Pendant la vie embryonale le système génito-urinaire est intimément relié au système génital.

2. La pyélite, les infections des urétères et d'autres parts du système urinaire causent souvent des douleurs bizarres abdominales et du gas dans l'estomac et les intestins.

3. Des infections des voies génitales et urinaires ont leur source souvent dans le trait gastro-intestinal. La méthode de Gram est souvent utile dans la diagnose différentielle d'une infection dans les voies urinaires.

4. Les cultures de l'urine peuvent être stériles. Mais souvent ils contiennent des microbes, qui produisent des infections urinaires ordinaires, surtout les bacilles coli.

5. Beaucoup d'infections urinaires peuvent être guéris par des préparations sulfonamides ou des antibiotiques comme l'auromycine ou terramycine, sans avoir besoin d'employer du penicilline ou streptomycine.

6. L'innervation du système génito-urinaire est dérivée des ganglions tout le long du plexus aorticus et céliacus.

7. Une évaluation exacte de l'étendu et de la sévérite de la maladie doit être faite avant que le conseil d'un avortement therapeutique soit donné.

8. La congestion dans les voies urinaires pendant la gestation favorise le dévéloppement de pyélo-nephrite.

9. La tuberculose rénale, le cancer rénal et la maladie polycystique des reins sont en général des contraindications de grossesse.

10. Il est souvent possible, d'éviter la pyélonephrite de gestation.

11. Pendant les dernieres quinze années un progres enorme s'est produit en chémotherapie antibiotiques et dans l'usage de la dermothérapeutique contre les infections des voies urinaires.

12. Un examen préliminaire de sensibilité est important.

13. La dilatation physiologique des urétères pendant la gestation peut être suivie des changements pathologiques. En général la dilatation est plus remarquable sur le coté droit que sur le coté gauche.

14. Les accoucheurs, gynécologues et urologes devaient travailler ensemble comme une équipe. En cas que cela n'est pas possible, l'obstétricien et le gynécologue devaient avoir une certaine connaissance des maladies urologiques chez la femme.

RIASSUNTO

1. Alcune nozioni di urologia sono indispensabili nella pratica ostetrica e ginecologica. Vi sono stretti rapporti embriologici fra il sistema urinario e quello genitale.

2. Le infezioni urinarie, comme quelle genitali, spesso sono di origine intestinale. Il metodo di Gram è molto utile per la diagnosi batteriologicà delle infezioni urinarie.

3. La pielite e altre infezioni urinarie spesso sono causa di dolori addominali vaghi, o di meteorismo.

4. L'urino-cultura può essere sterile, ma spesso contiene i germi delle infezioni urinarie e specialmente l'Escherichia Coli, il proteus e lo stafilococco aureo beta emolitico.

5. Molte delle infezioni urinarie possono essere curate con successo mediante i sulfamidici e gli antibiotici (aureomicina, terramicina). Penicillina e streptomicina non sempre sono necessarie.

6. L'innervazione del sistema genito-urinario deriva dai gangli dei plessi aortico e celiaco.

7. Ogni malattia deve essere vagliata accuratamente nella sua importanza e gravità prima di decidere sull'aborto terapeutico.

8. La stasi urinaria in gravidanza favorisce la pielonefrite.

9. Tubercolosi renale, carcinoma delle vie urinarie e malattia policistica del rene di solito controindicano la gravidanza.

10. La pielonefrite in gravidanza di regola può essere prevenuta.

11. Grandi progressi sono stati fatti negli ultimi 15 anni nella cura delle infezioni urinarie mediante chemioterapici e antibiotici.

12. E'sempre utile eseguire le prove di sensibilità.

13. La dilatazione fisiologica dell'uretere durante la gravidanza può divenire pericolosa; di solito è maggiore a destra.

14. Ostetrici, ginecologi e urologi dovrebbero agire di comune accordo, e quando ciò non sia possibile gli ostetrici e i ginecologi dovrebbero formarsi una preparazione in campo urologico.

ZUSAMMENFASSUNG

1. In der gynäkologischen und geburtshilflichen Diagnostik ist eine gewisse Kenntnis urologischer Erkrankungen unerlässlich. Der Harn-und der Geschlechtsapparat stehen embryologisch in engem Zusammenhang.

2. Infektionen des Harn-und Geschlechtsapparates stammen häufig aus dem Magendarmkanal. Die Gramsche Färbemethode ist bei der Diagnose von Infektionen des Harnsystems von Wert.

3. Nierenbeckenentzündungen, Harnleiterentzündungen und andere Infektionen des Harnapparates erzeugen häufig merkwürdige Bauchschmerzen oder Gasansammlungen im Magen und im Darm.

4. Aus dem Urin gewonnene Kulturen können zwar steril sein, enthalten aber auch häufig die bakteriellen Erreger, die im allgemeinen mit Infektionen des Harnapparates in Verbindung gebracht werden, besonders E. coli, Bac. proteus and B. staphylococcus haemolyticus aureus.

5. Viele Infektionen des Harnapparates lassen sich mit Sulfonamiden oder mit Antibiotika wie Aureomyzin oder Terramyzin heilen. Penizillin oder Streptomyzin sind nicht in jedem Falle notwendig.

6. Die Nervenversorgung des Harn- und Geschlechtsapparates stammt aus neben der Aorta liegenden Ganglien und aus den zöliakalen Geflechten.

7. Ehe eine therapeutische Unterbrechung der Schwangerschaft angeraten wird, muss die Ausbreitung und die Schwere der Erkrankung sorgfältig abgeschätzt werden.

8. Verlangsamung des Harnabflusses während der Schwangerschaft begünstigt

die Entwicklung einer Pyelonephritis.

9. Das Bestehen einer Nierentuberkulose, eines Krebses des Harnsystems oder einer polyzystischen Nierenerkrankung bildet im allgemeinen eine Kontraindikation zur Schwangerschaft.

10. Das Auftreten einer Schwangerschaftspyelonephritis lässt sich häufig verhüten.

11. In den letzten 15 Jahren sind auf dem Gebiete der Chemotherapie, mit Antibiotika usw. sowie in der dermatologischen Therapie grosse Fortschritte gemacht worden, die der Behandlung von Infektionen des Harnapparates zugute kommen.

12. Es empfiehlt sich, vor der Behandlung Sensitivitätsprüfungen auszuführen.

13. Die physiologische Erweiterung der Harnleiter während der Schwangerschaft kann zu krankhaften Veränderungen führen. Gewöhnlich ist die Erweiterung auf der rechten Seite stärker als auf der linken.

14. Zusammenarbeit von Geburtshelfern, Gynäkologen und Urologen ist erstrebenswert. Wo das nich möglich ist, müssen die Geburtshelfer und Gynäkologen Kenntnisse von den Erkrankungen des weiblichen Harnapparates besitzen.

RESUMEN

1. Para hacer el diagnóstico en ginecología y obstetricia se requiere cierto conocimiento de los padecimientos urológicos. Los sistemas genital y urinario se encuentran íntimamente relacionados desde el punto de vista embriológico.

2. Las infecciones del aparato genital y del genitourinario frecuentemente se originan en el aparato digestivo. La tinción por el método de Gram resulta útil para diagnósticar las infecciones urinarias.

3. La pielitis y otras infecciones urinarias frecuentemente producen dolores abdominales atípicos y meteorismo gástrico e intestinal.

4. Los cultivos de orina pueden resultar estériles pero frecuentemente contienen bacterias que generalmente producen infecciones urinarias tales como la Escherichia coli, Bacilus proteus y Stafilococo beta hemolítico.

5. Muchas infecciones urinarias pueden ser controladas con preparados sulfamídicos o antibióticos tales como aureomicina y terramicina. La penicilina y la estreptomicina no son necesarias en todos los casos.

6. La inervación del aparato genitourinario se deriva de los ganglios que se encuentran adyacentes a la aorta y de los del plexo celíaco.

7. Antes de que se recomiende un aborto terapéutico se debe hacer una valorización adecuada de la extensión y la gravedad del padecimiento.

8. El estasis de la vía urinaria que se presenta con el embarazo favorece el desarrollo de pielonefritis.

9. En la misma forma, la tuberculosis renal, el carcinoma de la vía urinaria y el riñón poliquístico constituyen una contraindicación para embarazo.

10. Frecuentemente se puede prevenir la pielonefritis del ambarazo.

11. En los últimos cinco años se han hecho muchos progresos por la quimioterapia, los antibióticos, etc. en el tratamiento, acerca del uso de la dermatoterapia y antibióticos, para las infecciones de la vía urinaria.

12. Es de valor el empleo de una prueba de sensibilidad.

13. La dilatación fisiológica de los ureteros en el embarazo puede producir cambios patológicos. Dicha dilatación generalmente es más marcada en el lado derecho que en el izquierdo.

14. Los tocólogos, ginecólogos y urólogos deben de trabajar formando un equipo. Si esto no se puede llevar a cabo entonces los tocólogos y los ginecólogos deberán de tener conocimientos de padecimientos urológicos femeninos.

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Human nature loses its most precious quality when it is robbed of its sense of things beyond, unexplored and yet insistent.

—*Whitehead*

Prevention of Fetal Wastage: The Obstetrician's Point of View

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THOUGH the safety and welfare of the mother are the primary concern of the obstetrician, it is well to recall that the fetus runs a close second. The obstetrician's obligation is unfulfilled unless a healthy mother goes home with an equally healthy child. Short of this he fails, no matter what the circumstances. Purely statistical considerations, therefore, should never cause him to withhold his surgical hand and persist in "masterly inactivity" while a fetus whose survival is jeopardized mutely depends on him for his only chance. In the many life-threatening complications that may arise, as has been emphasized by Aldridge, what is good for the mother is almost invariably good for the child. Accordingly, most correct decisions will benefit both lives concerned. Rarely indeed is it indicated to sacrifice the fetus for the safety of the mother, except possibly in such situations as persistent or worsening toxemia or uncontrollable hemorrhage from placenta praevia, prior to viability.

Review of the chief causes of fetal loss in the light of current accepted practice suggests that there is still much room for improvement. Particularly in this great medical center, the recent studies of Potter, Adair, Bundesen and others have focused our attention on this problem, with a widespread salubrious effect on the perinatal loss. In order of frequency, the causes of fetal loss are usually as follows: anoxia, severe malformations, intrauterine death of unknown cause, prematurity, erythroblastosis, birth trauma, infection and syphilis. Recurrence of these familiar threats to the fetus should recall previous experiences, personal or otherwise, in which the child was lost, and one's obstetric conscience should become sensitized and one's hands energized to interfere in Nature's process, if need be, to achieve a happier result. To learn from past experiences, sometimes sad, and apply these hard-learned lessons to the problem at hand is the obstetrician's duty.

In all complications of the causes of fetal loss, anoxia heads the list. Chief among causes of intrauterine anoxia are placenta praevia and abruptio placentae. Significant blood loss, whether maternal, fetal or both, means lowering of the oxygen supply to the fetus, who is already adapted to a perilously low level of oxygen saturation. Hence it is mandatory to control hemorrhage and replace lost blood promptly in both conditions. Uncontrollable hemorrhage in either case will force one to terminate the pregnancy in the maternal interest, no matter what the fetal chances are. More often, fortunately, the initial hemorrhage ceases, providing a "breather" and an opportunity for reevaluation of the case. In cases of placenta praevia, prior to the thirty-third or thirty-fourth week, digital examination of the cervix is best avoided, for fear of starting an uncontrollable hemorrhage that may force one's surgical hand. It is far better to make this diagnosis by exclusion,

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having ruled out polyp, bleeding erosion and carcinoma by speculum examination. Bed rest, sedation, replacement of blood by prompt and sufficient transfusions, plus patience, will enable many such problems to be carried beyond the thirty-fourth week, when the fetal chances are much better. In the absence of rectal examination and intracervical palpation to obtain scientific certainty of the diagnosis, rare indeed will be the necessity of terminating the pregnancy prior to this time, although the threat of alarming secondary hemorrhage is admittedly always present. For most primigravidae cesarean section is the method of choice for delivery, as well as in all cases of central placenta praevia. This is employed in about 75 per cent of all cases at the Margaret Hague Maternity Hospital. For the multigravidae with lateral placement of the placenta, simple rupture of the membranes will suffice in the presence of a favorable cervix, but in all cases the degree of hemorrhage, the parity and the condition of the cervix, and not the exact anatomic location of the placenta, determine the method of delivery. Bagging and version are now thoroughly passé in the treatment of this condition, and the Willett forceps is best used on a dead fetus, with a lateral placenta praevia.

In cases of abruption the pregnancy is best terminated when the diagnosis is made, while the patient is in good condition, regardless of the period of gestation, because the retroplacental hemorrhage may spread at any time after the initial episode, killing the baby and possibly causing severe damage to the uterine musculature, lower nephron necrosis in the maternal kidneys and, rarely, alarming afibrinogenemia. In the presence of an unfavorable cervix, cesarean section is by far the best solution. On the other hand, because of the irritating effect of the retroplacental clot, labor commonly ensues rapidly and progresses apace after abruption. Simple stripping and rupture of the membranes will speed up this process, particularly in multiparae. Intravenous pitocin infusions, possibly aided by the relaxing effect of conduction anesthesia, will help. Certainly in the presence of a dead fetus one should not rush in to do a cesarean section, unless the degree of continuing blood loss and shock make it essential to terminate this unfortunate pregnancy at once.

Although cesarean section was formerly used in about 30 per cent of cases of abruptio placentae at the Margaret Hague Maternity Hospital, in a recent ten-year series it was employed in only 14 per cent. In the conduct of those cases in which vaginal delivery is contemplated, shortening the second stage by judicious use of the forceps will save the babies in many cases of moderate and occasional cases of severe abruption. It is well to recall, however, that one is dealing with a highly lethal threat in which prompt abdominal delivery may save a few more severely jeopardized babies whenever immediate or soon forthcoming vaginal delivery is out of the question. The bad abruptions, in which the maternal shock and blood loss, whether external or concealed, are such that prompt abdominal delivery is the only safe thing to do for the mother, will always be a plague to the obstetrician. This is one of the few indications for cesarean section in the presence of a dead fetus.

Under anoxia are included fetal losses due to accidents involving the cord—prolapse, tight loops about the body, knots, a pathologically short cord, excessive torsion or rupture of the rare vasa praevia. Here the problem is one of prompt recognition and early oxygen therapy to the mother, while a plan of delivery is worked out. It is mandatory that the fetal heart be checked at least every fifteen minutes during labor, particularly after rupture of the membranes. During the second stage

knots and loops may be drawn tight, causing sudden fetal distress often manifested by violent activity. Constant attention at this time is essential to good results with the fetus; prompt but unhurried delivery should be accomplished whenever distress is evidenced. Caution must be exercised, however, to avoid undue and damaging speed in delivery, for it is easy, when impelled by the urgency of a fetal cacorhythmia or the obvious presence of a pulseless prolapsed cord to substitute birth trauma for anoxia as the cause of death.

Should severe fetal distress become evident when the cervix is not fully or nearly fully dilated, a flat abdominal roentgenogram is indicated to rule out gross fetal abnormality. Given a presumably normal baby in these circumstances, one would do well to forget manual dilatation of the cervix, followed by such procedures as version and extraction, and do an immediate cesarean section. This is the only method offering hope for the child. Accouchment forcé, followed by high forceps or midforceps application or version and extraction, sacrificed many mothers for the sake of badly and even fatally injured babies in the medieval era of obstetrics. Even with a fully dilated cervix, version and extraction under these circumstances has run up a sufficiently impressive score of ruptured uteri and injured children that it also would best be forgotten, except possibly in the case of a small fetus, a large pelvis, some amniotic fluid left in the gently relaxing uterus, a fully or nearly fully dilated cervix and an experienced versionist. But these conditions are rarely encountered.

Whenever these ideal conditions are not present, it is far better to place the patient in the deep Trendelenburg position to relieve the pressure of the presenting part against the pelvic brim, releasing the cord caught in between, while oxygen is administered by mask to the mother and preparations are made for an immediate cesarean section. At such times a trusty resident's hand in the vagina will dislodge the presenting part and hold it up long enough to permit safe delivery of the child. When the cervix is fully dilated, a judicious forceps or breech extraction from the midpelvis will solve the problem, but here again the hands trained in the use of Kielland and axis traction forceps and all the niceties of a safe breech extraction will yield the best results.

Another cause of anoxia is the cerebral compression resulting from prolonged labor. This carries a high fetal loss if incorrectly handled. When labor is protracted beyond twenty-four hours, or even earlier if progress ceases, the case should be reevaluated by a competent consultant. All obstetricians have learned the hard way that the mere fact that a patient is a multipara is no insurance at all that she will not have trouble in her current labor! Vaginal examination under sterile conditions is indicated to determine the cause of the delay, whether it be a malpresentation (brow or face), malrotation (such as occiput posterior or transverse, usually deflexed when causing delay), a pathologically firm cervix (recently emphasized by Calkins), a constriction ring, or a pelvis inadequate in size and architecture for the birth of this particular child. Relative disproportion is usually obvious; with firm pressure above, the presenting part, albeit molded as well as possible to fit the narrowed passage, simply does not engage. Under conditions deemed probably favorable for vaginal delivery the membranes may then be stripped and ruptured to improve the quality of labor and, in truly borderline cases, to insure that an adequate test of labor is being made. Plenty of intravenous fluid, adequate sedation and antibiotics are indicated, with due respect for those stalwarts who do not believe in prophylactic antibiotics. As Dr.

Waters suggested, the obstetrician is then given a sedative and is put to bed, while Nature is given a decent test of labor, to see what can be accomplished!

Of course, in cases of malpresentation and disproportion, cesarean section should be performed promptly. Prolongation of the impossible obstructed labor merely exhausts the mother, kills the fetus by a combination of anoxia and infection and wears out everybody concerned, for exactly nothing. Such meddlesome midwifery is radical in its disregard of the right of the fetus to a decent chance of survival. Nowadays in cases with favorable or borderline conditions, a first stage of twenty-four to thirty hours without adequate progress is considered by many an indication for section. Here the high social value of the child of an elderly primigravida, the first successful conception in a habitual aborter, a woman with history of prolonged sterility, or a primiparous breech in a borderline pelvis may weigh the decision toward cesarean section, and this is conservatism of the first order, from both the maternal and the fetal point of view. Poor, desultory labor, characterized by inertia, may be improved greatly, of course, by judicious use of infused pitocin in the absence of malpresentation, disproportion or uterine scar, and it is true that fewer sections are now being done for this indication. Such management will improve the formerly poor fetal results in cases of prolonged labor.

A few remarks concerning the fetal outcome in abdominal delivery are in order, for recent studies have emphasized the fact that this maternal panacea is not always the best solution for the fetus. Too many babies are still dying after cesarean section. Often, of course, the maternal indication for the section is simply lethal to the child, and when such cases are canceled out the fetal loss approaches, but never equals, the overall rate. Nevertheless, too many babies delivered by elective section do poorly, especially the premature. Prevention of premature delivery by elective section is largely accomplished by allowing the pregnancy to go to full term, dated at the onset of labor rather than two weeks prior to this date. Here a simple miscalculation by one month causes the pregnancy to be interrupted at thirty-four weeks rather than thirty-eight, and the surgeon's mask may scarcely conceal the chagrin he feels when he gazes upon the puny infant he has produced! This same error would be even more disastrous in the case of unsuspected twins. Preoperative estimation of the size of the fetus by palpation is difficult, and the distortion of roentgen images may make the fetus look larger than it is. Ossification centers have more scientific significance to the trained eye, and the radiologist may predict more closely the exact week of gestation. In general, however, one must simply learn to avoid elective section unless the child is large enough.

Careful suction of blood and fluid from the child's face during delivery should be the assistant's responsibility. The cord should be milked gently to give the baby an adequate increment of placental blood prior to clamping, and the child should then be placed in a warm crib in the operating room, under the immediate care of a resident obstetrician or pediatrist experienced in fetal resuscitation. Careful evacuation of the normally large amount of fluid in the stomachs of "section babies" may eliminate much of the respiratory difficulty observed among them. This is true particularly in the case of premature babies, in whom the hyaline membrane syndrome is more common. Occasional term babies delivered by section will also show evidence of hyaline membrane and meningeal edema as well, which are not present in those delivered *per vaginam*.

As in vaginal deliveries, the type of

analgesia, preoperative medication and anesthesia employed for cesarean section influence greatly the condition of the fetus. Heavy doses of barbiturates and narcotics through a trial labor, followed by slowly induced and prolonged general anesthesia, often depresses the child to such a point that persistent resuscitative measures, tracheal suction and even flagging may be necessary. Here is the great advantage enjoyed by babies delivered under conduction anesthesia, which also yields dividends in the maternal interest. In emergency section under such anesthesia, oxygen administered continuously to the mother during the operation will improve the fetal heart tones and give the baby a much better chance for survival.

During the days of my residency it was not uncommon to be called to the delivery room two or three times daily for resuscitation of severely depressed babies. Pharyngeal, tracheal and gastric suction, use of the Kreiselman apparatus and flagging, when necessary, were routine. In recent years the trend has been away from heavy doses of barbiturates and repeated doses of demerol or morphine and scopolamine, particularly when general anesthesia was to be employed later. The use of smaller doses of analgesic medicaments, supplemented by trilene and followed by local infiltration, saddle block or caudal, has obviated most of this problem, yielding babies who cry vigorously at birth unless compromised by some other cause of anoxia. These healthy trends will lead to ever better fetal survival rates and will tend to eliminate most of the problem of asphyxia neonatorum.

The toxemia of pregnancy accounts for much fetal loss *in utero*, in which autopsy usually fails to reveal any cause of death. At or near term there is no problem other than to choose the method of delivery. Termination by induction in favorable cases and section in unfavorable ones cures the toxemia, saves the babies and prevents remote renal damage from prolongation of the toxic process. At twenty-six to thirty-two weeks, on the other hand, the development of true toxemia is a thorny problem, of which, sadly enough, even the modern miracle-working derivatives of veratrum viride, apresoline and the alkaloids of Rauwolfia are no certain solution. Here one must gamble, for the fetus, the risk of prematurity outside the uterus against the risk of remaining in the highly toxic environment within. By all means one should attempt to carry the pregnancy through the thirty-third or thirty-fourth week, for the survival rate of premature babies rises percipitously after this period of development. Many babies, however, die *in utero* after two or three weeks of persistent toxemia, and further prolongation is bad for both mother and child. Fetal loss, renal damage and the development of hypertension later are the prices paid for procrastination in the presence of established toxemia. At such an early stage induction of labor and vaginal delivery are not often feasible, and nowadays recourse is more often had to section.

Especially lethal to the fetus and damaging to the mother is preeclampsia superimposed on preexisting hypertension, even of mild degree. In such cases, in spite of the most exacting regimes and close observation, high fetal losses will continue to plague the obstetrician. I have lost 2 such babies already this year. In cases of severe fulminating preeclampsia, no matter what the period of gestation, as soon as the signs and symptoms subside or become stabilized in response to sedative, diuretic and antitensive therapy the uterus should be emptied by appropriate means rather than left in *status quo* until the toxemia worsens again, with high fetal loss. Certainly after the thirty-third or thirty-fourth week the child's chances are infi-

nitely better outside. Finally, as has been emphasized by Falls, in the face of rapidly progressive toxemia that shows no response within twenty-four hours of intensive therapy, one's only recourse is to terminate the pregnancy on an emergency basis, chiefly to prevent full-blown eclampsia.

Such radicalism in the management of toxemia will save many more babies and spare many maternal kidneys severe damage. It will also avert such disasters as eclampsia and concealed hemorrhage due to abruption, complications that occur often enough to be feared by any obstetrician of experience. The usually negative autopsy observations on these babies, except for the degree of prematurity, suggests that the lethal factor is a chemical, presumably of placental origin.

Thus far this presentation has been concerned with such major problems as placenta praevia, abruptio placentae, cord complications and prolonged labor, under the headings of anoxia and toxemia, with some comments on the handling of babies delivered by cesarean section and the present-day trends in obstetric analgesia and anesthesia. Such major problems as prematurity and birth trauma will now be considered, followed by practical considerations as to the prevention of fetal wastage in cases of maternal diabetes, erythroblastosis, syphilis and abortion, with some additional comment on the present-day attitude toward treatment of the "habitual aborter." Some recommendations with regard to the future study of fetal loss are also presented.

Prematurity accounts for 50 per cent of fetal loss in the first ten days of life. The cause of premature termination of gestation is often apparent — placenta praevia, abruptio placentae, toxemia, premature rupture of the membranes, multiple pregnancy, etc.—but frequently the underlying reason is obscure. Despite brilliant advances in pediatric care, which nowadays permit the salvage of vastly more premature babies than was possible a few years ago, the fetal loss in this group remains high, owing chiefly to pulmonary immaturity. Every effort, accordingly, must be made to prevent premature labor by such measures as careful dietary instruction of all prospective mothers, especially in the low income group; conservative management of placenta praevia prior to the thirty-fourth week; careful supervision of hypertensive and preeclamptic patients; multiple pregnancies; hydramnios, and known "repeaters" of premature loss. In such cases there seems to be real value in prolonged bed rest, sedation and progesterone (and possibly stilbestrol) in quieting the tendency of the uterus to go into premature labor. In a recent case at the Margaret Hague Maternity Hospital a primigravida whose membranes ruptured at twenty-six weeks was carried by such means to thirty-seven weeks and was finally delivered of a healthy child weighing 5½ pounds (2,595 Gm.), after soaking nearly 900 vaginal pads with amniotic fluid. Eleven weeks in bed is quite a price to pay, but in this instance it paid off handsomely. More often, of course, the outcome is not so favorable, but the method is worth trying. For women who repeatedly miscarry at twenty-four to thirty weeks for no apparent reason, a very high protein and high vitamin diet, progesterone and stilbestrol in high dosage (although of debated value) and bed rest through the critical period of prior losses are well worth while.

Once it is evident that a premature delivery is forthcoming, consultations with both obstetrician and pediatrist are desirable to secure the best result. Whereas it was formerly necessary for the parturient to forego the usual sedation in the interest of her premature baby, the high degree of development of conduction anesthesia has

made it possible to circumvent this difficulty. By such means the fetus receives a high concentration of oxygen without the deleterious depressant effects of narcotics and barbiturates, with tremendous improvement in the all-important respiratory function. Gentle, slow delivery of the fetal head, aided if necessary by carefully controlled forceps with deep episiotomy to prevent undue pressure, while the mother receives adequate oxygen by mask, will yield rich dividends in fetal salvage. The alerted pediatric staff, present in the delivery room with adequate training and equipment for suction and resuscitation, will be only too glad to receive the premature child first hand and set it safely on its way to survival through the first few critical days of life.

Although the rate of fetal loss from birth trauma is gratifyingly less than in former years, in three types of deliveries it remains far too high, and the obstetric conscience should be sensitized to this tragic loss of otherwise normal babies. The difficult midforceps procedure should be done only by a competent obstetric consultant. Gone forever should be the days of attempting forceps delivery without definite knowledge that a pelvic abnormality, a malpresentation or a malrotation is present. No longer should one hear of pelvic application of forceps to unrotated heads, or of putting one's foot against the delivery table and pulling with all one's weight on axis traction forceps. Yes, many babies have been and still *can* be delivered in this way, but they will not all survive, and some will be spastic later on, to haunt the obstetrician's memory. When a competent consultant appraises such a situation, aided by roentgenograms of the maternal pelvis with the appropriate forceps in cephalic application, the amount of force presumably necessary to effect delivery even by his trained hands, after proper correction of malrotation, deflection and asynclitism, may be considered excessive for safety. Not only is it a question of what might happen to the delicate vein of Galen, the falx and the tentorium, but of the safety of the maternal tissues as well. It is by far the better part of valor to remove the forceps without further trial and to prepare to deliver the baby by section, preferably extraperitoneal. Certainly it is no unforgivable crime to admit that a "trial forceps" has become a "failed forceps"! Rather is it unforgivable to persist in doing what one's common sense should have told one to stop doing long ago. And this applies ever more to face, brow and deflexed posterior occipital presentations. Extraperitoneal cesarean section even at the eleventh hour is a far better solution, for, as one of my revered teachers often said, "After all, what is a cesarean section but a high forceps delivery through a suprapubic incision?"

In breech delivery the problem is even more closely pinpointed to lack of training, skill and judgment of the attendant present, for in any large series of stillborn term breech presentations birth trauma accounts for the loss of nearly three-fourths of all the babies. Intracranial hemorrhage, ruptured liver, adrenal hematoma and a host of assorted fractures, dislocations, nerve palsies, etc., make up an impressive list of traumatic insults to the breech. In general, since space does not permit adequate detail, let me emphasize cessation of all attempts at breech delivery through contracted pelvises of any type. At least 15 per cent of all primary breeches should be delivered by section and possibly more. And may I plead for elimination of the procedure of decomposition and extraction of a frank breech from the midpelvis, except in highly trained hands? And since even in such hands the mortality of term breeches is more than 2 per cent in most series reported, which is about four times the overall loss, obstetri-

cians would do well to reconsider the virtues of external version at about the thirty-second week. And with persistent breech presentations one would get far better results by awaiting presentation of the buttocks at the vulva and then doing an assisted breech delivery, consisting of a deep episiotomy, preferably with the region under local infiltration anesthesia, aided by the expulsive efforts of the mother up to the level of the umbilicus. At this point, quick induction of general anesthesia with some such agent as vinethine will permit completion of the delivery; Piper's forceps may be used whenever the head does not come down readily with the Wiegand-Martin or the Mauriceau-Smellie-Veit maneuver. Or, whenever the breech does not descend well to the vulva, one can perform a cesarean section. This may appear radical, but it is the only way in which the bad fetal results of breech delivery will ever be improved.

What is true of breech presentation is even more apposite to version and extraction, which I have already touched on in connection with prolapsed cord. In trained hands, under ideal conditions, such a delivery may be spectacular and a joy to behold, but this is rarely the case, and this procedure would better be omitted from textbooks, except as employed occasionally for the second twin, when indicated. Only by such means will the fetal loss from birth trauma be further reduced.

Maternal diabetes remains a controversial problem in obstetrics. The high fetal loss, which ranges up to 30 per cent, challenges the obstetrician to give patients with this disease the best possible diabetic control during pregnancy, for this appears to be the most important factor in improving fetal salvage. The use of parenteral stilbestrol and progesterone in large enough quantities to alter the hormonal imbalance so often present, as advocated by Priscilla White, is the crux of the controversy. It is only fair to state, however, that her carefully controlled patients have yielded the highest fetal salvage in any significant series (16 per cent in 685 cases). She stresses the classification of diabetes into six types of increasing severity, rigid medical control and prompt, vigorous treatment are instituted should edema, hydramnios or toxemia appear. The pregnanediol level is followed carefully, and a significant drop therein is also interpreted as an indication for emergency delivery.

In patients with severe diabetes the critical period for intrauterine death is the thirty-sixth week; hence it is well accepted that pregnancy in such a patient be terminated by the end of the thirty-fifth week, or sooner, should uncontrollable preeclampsia or hydramnios appear, or should the pregnanediol level fall. Vaginal delivery is favored for the three less severe types, when obstetric conditions are favorable and induction is feasible, up to the thirty-seventh week. Cesarean section is favored for women with more severe diabetes, whose pregnancies are interrupted at the end of the thirty-fifth week. Careful preoperative and postoperative management are essential, and spinal anesthesia is advised in all cases. The newborn children of such mothers must be under the care of an alert pediatric staff, who will take prompt action to remove excess pharyngeal and gastric secretions, relieve respiratory embarrassment, mobilize edema, correct excessively low blood sugar levels and particularly try to prevent the highly lethal hyaline membrane syndrome, which was observed in 85 per cent of the babies coming to autopsy. White, in 535 hormone cases in which hormone therapy was used, had only 11 per cent of fetal loss, easily the best figure on record.

Commenting on this question, Waters said that the fetal loss, due to bad timing,

in cases of diabetes is just as high as that from deferred interference. Certainly a nonsurviving prematurity is as bad as a death *in utero*, with a narrow range of safety between, i.e., about the thirty-fifth week. At New York Hospital, where hormone therapy is not used, much less rigid diabetic control was permitted and great stress was laid on the appearance of the eyegrounds as interpreted by a staff ophthalmologist, with prompt intervention when indicated by the increasing degree of vascular retinitis. Although routine cesarean section is certainly no panacea for the offspring of diabetic mothers, obstetric indications here carry greater weight in view of the huge size of many of these babies, their poor resistance to difficult labor and birth trauma and, on the other hand, their hazardous neonatal course, especially when premature. Vaginal delivery of milder involvement, favorable for induction and cesarean section for the more severe, plus adequate diabetic control, sufficient hormone therapy if any is used, and prompt intervention when indicated, will yield better results in this difficult group.

With erythroblastosis, as with diabetes, the closest cooperation between obstetrician and pediatrist will yield the best results. When antibody titre is increasing there is a great temptation to get the baby out of the toxic environment, once he is well beyond the danger of pulmonary immaturity. Outstanding authorities, such as Diamond, have demonstrated, however, that these babies do not tolerate prematurity well. Exchange transfusion may prove too shocking to the premature cardiovascular system. Accordingly, the concept of pre-term induction is now favored by some "middle roaders," and it does seem reasonable to remove the child from the noxious antibodies before he is seriously damaged. Certainly at thirty-six weeks or later most babies have a good chance for survival, and it seems to me that one should probably not hesitate to interrupt such a pregnancy with the aid of local infiltration or spinal anesthesia, with the pediatric staff ready for immediate typing and a Coombs Test of the cord blood, with exchange transfusion when indicated. This seems infinitely better than to wait until fetal motion ceases and a hydropic stillborn child is subsequently delivered—or a child severely anemic or even severely icteric within a few hours of birth, possibly beyond the point of complete recovery. I also favor the use of large amounts of vitamin C throughout all RH-negative pregnancies, in accordance with the work of Javert.

Maternal syphilis, formerly a frequent cause of fetal loss, need not be a problem nowadays, but one should not become overcomplacent about it. Prompt diagnosis and adequate treatment with penicillin prior to the third trimester is of course essential. It seems needless to repeat that all maternity patients are required by law to take serologic tests during each pregnancy and that failure to do this constitutes gross negligence.

One of the largest groups of fatally damaged babies has purposely not been discussed so far. This is the group with major abnormalities incompatible with life. Although one may say correctly that nothing can be done at this stage of knowledge to prevent such losses, obstetricians should endeavor to teach their patients to avoid all viral diseases in early pregnancy; to avoid all but absolutely essential exposure to toxins and radiation in the early weeks, and to maintain as high a level of general health and nutrition as possible.

And now a final word about fetal loss from abortions, both early and late: As is well known, the vast majority of such fetuses are abnormal, and the Almighty wisely excludes these from the already

heavily burdened human family. About 10 per cent of all conceptions fall into this group. Whenever signs and symptoms of threatened abortion persist, in spite of therapy, for longer than one week, the pregnancy is usually a lost cause, and both psychic and economic interests are best served by a carefully performed curettage. Urine pregnancy tests at this time commonly will show a weakly positive or a negative result.

On the other hand, however, it is mandatory that we treat women threatened with abortion, both early and late, as well as threatened premature labor, with all the available agents of proved value. Controversy rages in research circles over stilbestrol, various vitamins, progesterone, thyroid extract, etc., but it seems only fair that practitioners should use whatever promising agents are at hand—with discretion of course. Bed rest, a high protein and high vitamin diet and certain restrictions concerning coitus and travel at the time of missed menses may help. I am personally partial to thyroid extract, vitamin C, stilbestrol and progesterone, but I admit that this is empiric therapy at best. Stilbestrol, which theoretically is absorbed best in the micronized form, may mask a missed abortion or may even make a missed abortion of one that was originally threatened, but I have delivered many normal babies from mothers whose bleeding stopped after heavy doses of this drug. One must continue to increase fetal salvage at every stage of gestation, in the face of all the life-threatening complications, awaiting the discovery of ever more potent agents that will strengthen one's hands.

Current suggestions by some that "habitual aborters" be treated prior to conception are worthy of trial. After several months of weight reduction, cyclic therapy of estrogen and progesterone, high vitamin and high protein diet, planned coverage and fertilization of "fresh ova" by an abundant daily supply of sperm throughout the fertile period from the eleventh day on, would seem to hold promise. Early diagnosis of pregnancy, with careful observation of urinary pregnanediol or vaginal smear studies to assay the endogenous progesterone supply, with prompt administration of adequate progesterone when indicated, has a more rational basis than the "shotgun" now employed by most obstetricians.

SUMMARY

The author summarizes the currently accepted practices at the Woman's Hospital and the Margaret Hague Maternity Hospital of Jersey City in dealing with the common causes of fetal loss. He states that the whole compass of obstetrics may be included in this almost endless discussion. Time does not permit but the mention of such rare fetus-saving measures as abdominal paracentesis in cases of acute hydramnios, the proper attitude toward postmaturity, or the avoidance of excessively rapid and traumatizing labor in multiparae induced by routine pitocin infusion, which bids fair to supplant normal labor in some localities. He expresses hope that the therapeutic suggestions here made of 1953-54, will focus the attention of obstetricians particularly on the problem of greater fetal salvage. As a guide, he suggests study of the detailed and comprehensive work sheet devised by Calkins and published in a recent issue of the *American Journal of Obstetrics and Gynecology.*

RESUMEN

El autor hace un resumen de lo que se ha aceptado comunmente en el Hospital para Mujeres y en el Hospital Maternidad Margaret Hague de Jersey City, en relación con las causas habituales de péridida fetal. El autor afirma que en esta discusíon infinita puede incluirse todo el campo de la

obstetricia. Debido a la escasez de espacio solamente se mencionan casos raros en los cuales una paracentesis abdominal salvó casos de hidramnios agudos, también se menciona la conducta a seguir hacia la postmadurez y para evitar el parto rapido y traumatizante en la multípara inducido por pitocín en venoclisis que se usa en algunas localidades con el objeto de substituir el curso normal del parto. El autor expresa su esperanza de que las sugestiones terapeúticas que se hacen aquí de 1953-54, llamen la atención de los parteros particularmente con relación al problema de la salvación del feto. Como guía, el autor sugiere un estudio del trabajo detalado y comprensivo desarrollad por Calkins y publicado en un número reciente de la revista *American Journal of Obstetrics and Ginecology.*

ZUSAMMENFASSUNG

Der Verfasser gibt einen Überblick über die im Woman's Hospital und im Margaret Hague Maternity Hospital in Jersey City akzeptierten Methoden zur Bekämpfung der alltäglichen Ursachen des Verlusts ungeborener Kinder. Er weist darauf hin, dass die fast grenzenlose Diskussion dieses Problems das gesammte Gebiet der Geburtshilfskunde einschliesst. Die Kürze der Zeit gestattet nicht mehr als die Erwähnung gewisser seltener fötusrettender Massnahmen wie die Punktion der Bauchhöhle in Fällen von akutem Hydramnion, die richtige Einstellung gegenüber dem Übertragen der Frucht und die Vermeidung eines übertrieben raschen und traumatisierenden, durch routinemässige Infusion von Pitressin bei Mehrgebärenden eingeleiteten Geburtsvorganges, der an manchen Orten den normalen Geburtsvorgang zu ersetzen verspricht. Der Verfasser hofft, dass seine in den Jahren 1953 und 54 aufgestellten therapeutischen Vorschläge die Aufmerksamkeit der Geburtshelfer besonders auf das Problem der Erhaltung des Fötus in grösserem Umfange lenken mögen. Als Leitfaden schlägt er das Studium des detaillierten und umfassenden Arbeitsplans vor, den Calkins aufgestellt hat, und der in einer der letzten Nummern des *American Journal of Obstetrics and Gynecology* veröffentlicht worden ist.

RÉSUMÉ

L'auteur résume les méthodes adoptées a "Womens Hospital" et "Margaret Hague Maternity Hospital" a Jersey City en evaluant les causes ordinaires de la mortalité foetale. Il croit que la domaine entière de l'obstetrie devait être inclue dans cette discussion indéfinie. Le temps ne permet que de faire mention des mesures rares, comme la paracentèse abdominale dans les cas d'hydramnios aigu, la propre attitude envers la postmaturité et la nécessité d'éviter du dommage fait aux femmes multipares par un accouchement excessivement rapide a l'aide d'infusions de pitocin, traitement qui parait prendre la place de la couche normal a quelques endroits. Il espère que les recommandations therapeutiques qu'il a donné en 1953/54 vont diriger l'attention des accoucheurs au problème d'une meilleure conservation de la vie foetale. Il recommande l'étude du guide detaillé et compréhensif de Calkins qui était publie récemment dans le Amer. Journal of Obstetrics and Gynecology.

RIASSUNTO

L'autore espone i metodi in uso al Woman's Hospital e al Margaret Hague Maternity di Jersey City per combattere le cause più comuni della mortalità fetale. L'argomento abbraccia tutta l'ostetricia e ne seguirebbe un discussione senza fine; per ragioni di tempo, tuttavia, egli si limita a ricordare la paracentesi dell'addome nell'idramnio acuto, il trattamento della post-maturità, l'abolizione di parti

troppo rapidi e traumatizzanti come sono quelli che si ottengono con l'uso della pituitrina.

Egli esprime, inoltre, la speranza che questi suggerimenti potranno richiamare l'attenzione degli ostetrici sul problema della neonati-mortalità e li invita a leggere un lavoro di Calkins pubblicato recentemente sull'American Journal of Obstetrics and Gynecology.

It is very difficult to be wholly joyous or wholly sad on this earth. The comic, when it is human, soon takes upon itself a face of pain; and some of our griefs (some, not all, for it is the capacity for suffering which makes man august in the eyes of men) have their source in weaknesses which must be recognized with smiling compassion as the common inheritance of us all. Joy and sorrow in this world pass into each other, mingling their forms and their murmurs in the twilight of life as mysterious as an overshadowed ocean, while the dazzling brightness of supreme hopes lies far off, fascinating and still, on the distant edge of the horizon.

Few men realize that their life, the very essence of their character, their capabilities and their audacities, are only the expression of their belief in the safety of their surroundings. The courage, the composure, the confidence; the emotions and principles; every great and every insignificant thought belongs not to the individual but to the crowd: to the crowd that believes blindly in the irresistible force of its institutions and of its morals, in the power of its police and of its opinion. But the contact with pure, unmitigated savagery, with primitive nature and primitive man, brings sudden and profound trouble into the heart. To the sentiment of being alone of one's kind, to the clear perception of the loneliness of one's thoughts, of one's sensations—to the negotiation of the habitual, which is safe, there is added the affirmation of the unusual, which is dangerous; a suggestion of things vague, uncontrollable, and repulsive, whose discomposing intrusion excites the imagination and tries the civilized nerves of the foolish and the wise alike.

—*Conrad*

Ophthalmologic and Otolaryngologic Surgery

Logical Use of Orthoptics

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THE intelligent use of orthoptics, basically an invaluable technic in the treatment of oculomotor disturbances, is dependent upon a knowledge of the development of a single binocular vision and the physiologic function that makes it possible to maintain single binocular vision under normal circumstances. Equally important is an understanding of the basic faulty physiologic picture of comitant strabismus and those secondarily developed attributes which result in the oculomotor deviations, as well as the characteristic deviations that identify noncomitant strabismus.

There is no doubt whatsoever that there are several different basic causes of comitant strabismus; these, in their principal characteristics, being quite different one from the other. Because of this fact (and clinically it is confirmed every day) there are different types of comitant strabismus resulting from these different causes. One might say there are as many different varieties of comitant strabismus as there are possible causes. It hence follows logically that the pathologic physiologic picture in cases of strabismus, while peculiarly characteristic for each causative factor, can be and is different in the varied types.

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The medical treatment of strabismus, which includes the utilization of orthoptics, was started long before the pathologic physiology of strabismus was known; in fact, the principles underlying the development of single binocular vision were not known. This is very evident when one reads about procedures and the various appliances recommended at that time. A reference appears in an Egyptian papyrus dated about 1650 B.C. This reference was quoted as authoritative in a medical manuscript of the Byzantine middle ages, written by a physician who lived between 625 and 690 A.D. Paré, eight hundred years later, continued recommending the same methods of treatment. Buffon, in 1743, presented the first attempt to explain the cause of strabismus upon the bases later expanded by Donders and Helmholtz. Parinaud, in 1903, was the first to comprehend the relation of the central nervous system to squint, and Claude Worth, in 1929, in the first edition of his work on the treatment of strabismus, presented a working basis upon which modern orthoptics could develop.

The names of many workers have been omitted in this very sketchy history of strabismus as related to orthoptics. This omission does not belittle their contributions, however, in any way. Maynard C. Wheeler, in 1942,[1] presented beautifully

and compactly a history of orthoptics which should be known in detail by every ophthalmologist.

To paraphrase Giles,[2] the knowledge of when to treat, what to treat and when not to treat, is the basis of this presentation. It is most unfortunate, but true, that orthoptics as a therapeutic procedure is being grossly misused at present—in fact, prostituted (in the true sense of the word) and is in danger of becoming discredited by many ophthalmologists as well as by the lay public because of this misuse, regardless of whether it is deliberate or due to ignorance. Those at fault include (and it must be said with shame) some ophthalmologists, as well as some practising orthoptists and orthoptic technicians who, through circumstances not always of their own making, are practising without the active guidance of an ophthalmologist. In addition, it can be said from observation that some optometrists capitalize this means of income production without knowing what they are doing or why they are doing it.

A brief detailing, at this time, of certain cases is convincing as to the statement just made:

1. A child aged 8, under the care of an ophthalmologist, was treated for two years in an institution orthoptic clinic with no change whatever in the oculomotor condition present. The child had convergent strabismus of about the same degree for near vision and for distance. There was no vertical component connected with the strabismus. The visual acuity was 6/6 in each eye. The child was alternately suppressing. There was no determinable single binocular vision of any degree, and refractive errors were negligible. This was a classic case of essentially alternating convergent strabismus.

2. A 9-year-old girl had visual acuity of 6/150 on the right and 6/6 on the left; disturbances in the ocular motility of the superior and inferior oblique muscles of the left eye; inadequate spectacles, and intractable amblyopia (a form of amblyopia rather characteristic of arrested development). There was no torticollis, and no defects in retinal correspondence were present. The case had been referred directly to the orthoptist by the child's parents, and she had eight months of orthoptic treatment by an orthoptic technician (self-employed), which included, at times, daily visits to the orthoptist, masks, partial occlusion of the spectacle lenses with white paint and black tape, and occlusion of the fixing eye for varying numbers of hours per day—a procedure of no value with this type of amblyopia and certainly of no value unless used as complete occlusion for certain definite planned periods.

3. An 8-year-old boy had alternating divergent strabismus, with marked overaction of both inferior oblique muscles and limitation in the elevation action of the superior rectus muscles, with alternate suppression and the barest rudiments of single binocular vision. He was under treatment for over a year by a physician and an orthoptist.

4. A girl 14 years of age had 6/6 and 6/60 vision; a combination of characteristics of accommodative and nonaccommodative comitant convergent strabismus; anomalous retinal correspondence, disharmonious in type. She was treated intensely for three months by an optometrist, with so much success in this retraining of retinal function that, without any change in the degree of manifest deviation, with no improvement in the suppression and amblyopia, and with the establishment of such a remarkable degree of so-called third degree fusion in the strabismus and with the extrafoveal retina, that one must wonder what will happen when horror fusionis occurs, as it almost

certainly will, when at the age of approximately 18 this young lady is no longer willing to continue cross-eyed and seeks surgical aid of her own volition because of the cosmetic blemish.

These 4 cases can be matched repeatedly in private offices and in hospital clinics, all originating from the same sources; all those concerned being equally at fault to a degree proportionate to their professional training, their probabilities, their possibilities and their capabilities for doing harm or good.

This discussion of the intelligent utilization of orthoptics, is not considering the treatment of the phorias as related to orthoptics. In making this statement I am fully aware, at the same time, of that poorly demarcated line of differentiation which exists, in diagnosis, between a phoria and a tropia. It almost seems that one situation is subjective and the other objective, the latter the monstrous child of the parent former. Certain truisms are basic. Convergence insufficiency exophoria and convergence excess esophoria are ideal oculomotor situations for the utilization of orthoptics, thus illustrating the therapy for a phoria.

Certain manifest oculomotor disturbances cannot respond to orthoptics because of their etiologic and anatomic nature. There are other conditions in which orthoptics had some value. A third group of cases exists in which orthoptics is of paramount importance in the treatment. Orthoptic procedures, as therapeutic procedures related to strabismus, have their ideal application in the correction of the residual phorias present after the best results obtainable in the correction of the deviated visual axes after logical operation. This is repeating what has just been said about the ideal application of orthoptics to the treatment of the phorias.

Another point of importance is that orthoptics, with the examinations and instrumentation related to this specialty, has an outstanding place in preoperative diagnosis, rather than in the role of the wholesale, hopeful, wishful-thinking panacea too often used preoperatively. The postoperative application of orthoptics has already been mentioned and reemphasized. This statement, which is in part a generalization, does not mean disregard of suppression and amblyopia, anomalies of retinal correspondence, faults of fixation and faults in prism convergence and/or prism divergence.

In many cases of squint there is a significant functional aspect; hence it is necessary, in the intelligent use of orthoptic procedures, to consider the age of the patient and to investigate his psychic makeup, as well as the attitudes of members of his family, parents, associates and acquaintances, playmates and teachers. The last-mentioned group is frequently at fault (another observation of sad experience), at times deliberately and at other times through ignorance, during this period of a patient's medical life.

While most responsible orthoptists eliminate patients with noncomitant strabismus in the horizontal, many, for reasons known only to themselves, do not reject those who have noncomitant strabismus in the vertical, that is, those with paralytic or paretic vertical components. There is a marked difference in the demands made normally upon the horizontally acting and the vertically acting muscles. There is a constant necessity for disjunctive movements in the horizontally acting muscles for both distance and near vision, but this does not apply to the vertically acting muscles. These must maintain a constant vertical parallelism between the two eyes, regardless of the level or the direction of gaze. Because of this, the amplitude for horizontal reflex binocular adjustment is flexible, with quite a breadth, while that for vertical binocularl-

ty is inflexible and exacting, providing but little, if any, significant breadth—in both instances for the conditioning as well as the maintaining of a normal binocular balance. As Fink[3] said, "We have, therefore, in the vertical component a fixed relationship with a very limited range of reflex power of adjustment, while the horizontal component is endowed with great power of adjustability."

The horizontal noncomitant conditions to be promptly rejected for orthoptic treatment are the retraction syndrome, strabismus fixus, subtotal or total horizontal oculomotor paralyses, and the not uncommon horizontal comitant strabismus with an oblique muscle fascial sheath syndrome. In many cases of horizontal comitant strabismus there is malfunction of the vertical muscles, and it is necessary to decide whether this vertical component is primary, paretic and the basic cause of the horizontal strabismus or whether it is secondary to the horizontal strabismus and basically not an etiologically responsible factor. It is lost time and a waste of money to attempt an improvement in any case of comitant strabismus in which a vertical component is paretic or paralytic. A vertical component need not be present in the amblyopic eye. The horizontal strabismus and the amblyopia develop in the eye with the higher refractive error because of the necessity for suppression due to the intractable diplopia of a constantly changing vertical deviation from parallelism. The uncovering of a vertical element and the diagnosis of the primary and secondary characteristics are therefore basic. It is necessary not only to make a diagnosis of the type of lateral strabismus present but to identify the vertical muscles involved. The presence of torticollis or of head facing is a manifestation of an etiologically significant vertical component (unless due to ocular nystagmus), as are also suppression of vision and amblyopia. Torticollis associated with horizontal strabismus is a manifestation of the patient's struggle against an intractable, etiologically significant, paretic type of vertical component, and the necessity for suppression, with its subsequent train of faulty retinal physiologic characteristics.

It is rather interesting that in cases of accommodative strabismus with a vertical component this vertical disturbance seems to appear rather late in childhood and is frequently encountered in patients in whom the major portion of the lateral strabismus is corrected by proper nonsurgical treatment. One might think that orthoptic procedures for the accommodative strabismus would also cure or at least prevent this vertical muscle spasm, if the assumption is correct that the vertical deviation in these cases is the result of the convergence excess and the accompanying circumstances, anatomic, physiologic and neurologic. It is rather likely that the assumption is correct. Nevertheless, this type of muscle spasm will not always respond to orthoptic treatment. It may become as much a surgical component of accommodative strabismus as is that portion of the horizontal strabismus which remains under full atropinization after correction of the suppression, the amblyopia and the anomalies of retinal correspondence.

Earlier in this presentation, comitant strabismus was roughly divided into three classes on the basis of their applicability to the use of orthoptic treatment. The first of these is that group of cases (again speaking only of comitancy in the horizontal and the vertical) of functional defect types, as one sees with alternating convergent or divergent strabismus. Alternate suppression is present without amblyopia. The angle of deviation varies but little, whether measured objectively or subjectively; it is approximately the same for near vision and for distance, and re-

fractive errors are not etiologically significant. Anomalies of retinal correspondence are rare. Associated with this condition is a profound defect in ability to develop binocular single vision, which is at times entirely absent and at other times barely present. The characteristics of this type of strabismus have a basic individuality; therefore, orthoptics can have no preoperative place in the treatment and is of value only postoperatively, if at all. This doubtful value depends upon that modicum of binocularity which may be present, and because of this upon the presence of faulty physiologic changes peculiar to that possible state.

The condition is the extreme opposite of that which justifies orthoptic treatment of the phorias. For the moment, the term "fusion" is to be considered an adjective describing the degree to which binocular single vision has developed as a reflex. Thus, a fusional attribute or reserve makes possible the utilization of orthoptics for patients with the phorias. Adjective or noun—cerebral function or conditioned reflex—regardless of what it may actually be, its absence nullifies the applicability of any orthoptic procedure.

The second group consists of those conditions for which orthoptic procedures are of great value but not of paramount importance. This group is a large one, including types of so-called accommodation in which the squint decreases or disappears at near vision, with relaxation of accommodation - convergence. It is the strabismus of Buffon, of Donders, of Helmholtz, of Worth and of Maddox. The etiologic stages in its development are potentially reversible, and through that process binocular single vision (with utilization of the macula in each eye) is theoretically possible. Refractive errors are etiologically significant; hence their correction is basic. The secondary characteristics are suppression, amblyopia, anomalous correspondence and, probably, some late muscle fibrosis. I shall say more about this a little later.

The application of orthoptics is to the correction of these conditions. The three mentioned, suppression, amblyopia and retinal correspondence defects, are so interrelated that, in the majority of cases, correction of one means correction of the others. It is not only cruel but stupid to hammer at a 5-year-old patient because of an anomaly of retinal correspondence without first overcoming the suppression. Similarly, so-called retinal massage, whirligig machines and to-and-fro alternating machines have doubtful value. They are too frequently tolerated stolidly but produce no therapeutic results. Suppression must be broken up first. The basic essential is occlusion of the nonstrobotic eye. If alternation develops as a result of this, well and good. In many cases of accommodative strabismus these are surgical indications, and this development may present one such situation. Mention has been made of the vertical component of accommodative strabismus. This is always an indication for surgical treatment, and similarly so, frequently the condition is consequent to the horizontal deviation. The other surgical aspect is probably connected with the muscle fibrosis mentioned and is that degree of strabismus, usually greater for distances than for near vision, which remains uncorrected after these etiologically significant characteristics of accommodative strabismus have been corrected.

The third type of strabismus, and that with the strongest relation to orthoptics, is that in which there is a minimal accommodation-convergence relation. There are frequently profound retinal physiologic defects. This type of strabismus ranges from convergent to divergent deviations through the insufficiencies and the excesses of abduction and adduction, illustrating,

in many instances, the inadequacy of the accommodation-convergence theory. Strabismus of this variety is an innervational disorder due to faulty development of the central nervous system in which the primary visual centers have failed to control the functions of convergence and/or divergence, with resulting faulty binocular vision. The patients in these cases need most careful preoperative studies by the orthoptist. (The orthoptic correction of secondary characteristics and the postoperative application of orthoptics have already been described and lauded as applicable to the phorias.) Postoperatively, these patients are for a time in a No-Man's-Land of esophoria and esotropia, or exophoria and exotropia, and it is at this stage that orthoptics has its greatest value, unless one is to be satisfied with cosmetic improvement as the basis of treatment.

A last group of cases must be mentioned, in which the only value of orthoptics is correction of the suppression (when present) if it is possible to establish, by operation, a vertical and a horizontal comitance. This type includes the strabismus associated with various mechanical anomalies, such as muscle excursion defects, faulty tendon insertions, the etiologically significant vertical muscle faults, disturbances of the fascial sheath and the abnormal action of any or all muscles involved, such as various subtotal limitations in vertical and horizontal oculomuscular motility, paralytic or otherwise. The development of binocular single vision depends upon the possibility of establishing comitance. The prognosis for such perfection is doubtful. Orthoptics, therefore, in this type of case can have little value. It seems interesting that this basic fact is not believed by many of the persons concerned.

SUMMARY

The author emphasizes the fact that orthoptics as a therapeutic measure is grossly misused, quoting Giles[2] as to the importance of knowing "what to treat and when not to treat," and is therefore in danger of becoming discredited. He cites a number of cases in evidence. Legitimate uses of orthoptic methods are also pointed out.

ZUSAMMENFASSUNG

Der Verfasser betont, dass die Anwendung mechanischer Übungen des Auges als therapeutische Massnahme grob missbraucht wird und zitiert Giles,[2] der sagt, wie wichtig es ist zu wissen, "was man behandeln soll, und wann man nicht behandeln soll." Die Methode ist in Gefahr diskreditiert zu werden. Der Verfasser führt eine Reihe einschlägiger Fälle an und weist auch auf die gerechtfertigten Anwendungsmöglichkeiten der mechanischen Augenübungen hin.

RIASSUNTO

L'autore mette in rilievo il fatto che la terapia ortottica è spesso male impiegata, e cita Giles a proposito della importanza di sapere ciò che si deve e ciò che non si deve fare. Il metodo deve essere impiegato con criterio.

RÉSUMÉ

L'auteur souligne le fait que les méthodes d'orthopédie, comme mesure thérapeutique, sont grossièrement abusées par la profession. A cet effect il cite Giles, concernant l'importance de savoir "ce qu'on doit traiter et quand on ne doit pas traiter," s'il on veut que l'orthopédie ne perde pas son prestige. Il présente aussi un nombre des cas et il énumère une sérvie des méthodes orthopédiques.

SUMÁRIO

O autor cham a atenção para o fato de que a Ortoptica como medida terapeutica é muitas vezes mal empregada e cita? Giles quanto à importancia de saber "o que tratar e quanto não tratar," havendo portanto o perigo de que a mesma entre em discredito. Apresenta varios casos. São indicados os usos legitimos dos metodos ortopticos.

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Jenner's best memorial occurs in Queen Victoria's diary. His greatest patient was no expert in medical philosophy, but she was a very good judge of men, and she admired this robust and independent doctor. "Much grieved to hear that good old Sir William Jenner, who had been for so many years (from '61 to '93) my physician, had died this afternoon. He had been a most devoted and faithful servant of mine, a most able doctor, and a truly kind friend, to whom I could always speak frankly and confidentially. I have greatly missed him during the last five years, when he could no longer come to see me. He had been with me during the saddest moments of my life, having been most kind and attentive at this most terrible time, now thirty-seven years ago: again at Sandringham, during Bertie's most alarming illness in '71, and when dear Leopold was so dreadfully ill on two occasions, and Sir William, under Providence, really saved his life. On many other trying and sad occasions he showed much kindness, and was always full of sympathy, though naturally of rather an irascible temper. He gave up travelling with me after the year '79, never going any more either abroad or to Scotland. It is another link with the past gone, and I feel it very much."

—*Williams*

The Ridley Intraocular Acrylic Lens Operation*

Comments and Modifications

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EXTRACTION of the cataractous lens, even with the most expert surgical technic and the most nearly perfect cosmetic result, is but half the treatment for the patient. The problem of treating induced aphakia is still unsolved. No aphakic lens is manufactured, even among those of the latest optical patterns, that can supply the answer. Contact lenses are useful to some patients, but even these only reduce the size image of the aphakic eye by one-half, leaving a disparity of image size amounting to about 15 per cent. The cure for cataract will be complete only when the important portion of the eye (the lens) is replaced within the eye and the patient thus obtains single binocular vision. The aphakic glasses available at present produce spherical aberrations, distortions and a limited field of vision, to say nothing of the patient's complete inability to perform ordinary tasks, such as shaving, walking and eating, without the aid of glasses. Because of the enlargement of the image, the visual acuity in cases of aphakia is considerably less than is indicated by the usual clinical tests.

In 1951 Ridley developed his intraocular lenticulus operation. My experiences with this procedure over a period of almost three years leads me to the following practical conclusions:

1. I have discarded the preoperative use of homatropine or any other cycloplegic drug and now use 4 per cent cocaine and epinephrine 1:1000 instilled in three doses and followed by retrobulbar injection of 1 per cent procaine in hydrochloride (hyaluronic acid). This enhances the mydriasis produced by cocaine. One must carefully gauge the mydriatic effect, so as to obtain a pupil measuring 5 to 6 mm. This is the optimum degree of dilatation both for extracapsular extraction and for placement of the lenticulus.

The response to pilocarpine at the termination of the operation is quite rapid and is enhanced by gently stroking the iris to produce more complete miosis. Profuse irrigation with saline solution will also aid in this process.

2. The peripheral iridectomy should be very small and placed at the point of attachment of the iris to the scleral spur.

3. The use of a sharp knife for a clean excision of the anterior capsule prevents accidental dislocation of the entire lens with an unintentional intracapsular extraction. Capsular tags should be excised, not pulled out with capsular forceps.

4. The lenticulus should be placed, gently but firmly, inferiorly behind the iris border. There is no fear of dislocation if it is kept in position with a spatula while the superior border of the iris is teased over it.

5. The pupillary border of the iris should be raised with a special iris elevator at the superior pole. The special iris needle employed by Ridley produces more traumatism and a greater release of iris pigment than does the smooth iris elevator.

*Operative technic shown in Kodachrome motion pictures at Geneva.

Read at the Twentieth Anniversary Congress of the International College of Surgeons, Geneva, May 6-10, 1955.

Submitted for publication Aug. 20, 1955.

6. At the end of the operation the iris should be stroked to stimulate even constriction of the pupil. One should make sure that the iris is not impinged upon, either at or near the chamber angle.

7. Thorough irrigation with physiologic solution of sodium chloride before and after insertion of the plastic lens is to be recommended, especially if the iris has been unduly traumatized.

8. The lens should be positioned *after* the iris has been symmetrically stimulated and the pupil is round and centered.

9. Milky white cataracts, intumescent and morgagnian cataracts lend themselves to this technic, particularly as with thorough lavage all cataractous particles are removed.

10. The subconjunctival injection of hydrocortone suspension (2.5 per cent) into the inferior cul-de-sac at the termination of the operation and the use of cortone or hydrocortone systemically has a tendency to prevent the formation of exudates on the anterior lens surface or the incarceration of pigment granules within it.

11. Pilocarpine 4 per cent, at the termination of the operative procedure is recommended.

12. Homatropine, 2 to 4 per cent or even atropine, 1 per cent, at the first dressing (twenty-four hours later), to prevent synechiae and obtain a 4 to 5 mm. pupil, is advised.

13. The acrylic lens prevents anterior displacement of the vitreous and reduces the incidence of retinal attachment and corneal edema.

14. A mobile pupil is an absolute prerequisite—free of all synechiae, especially those near the pupillary border. If synechiae following trauma are present, these adhesions should be severed prior to operation for cataract.

15. Monocular cataracts, particularly in young patients. These are particularly well adapted to this procedure.

16. Monocular traumatic cataracts, provided the posterior capsular is not perforated.

17. Juvenile mature cataracts, even if complicated by diabetes, provided the diabetes is well controlled medically.

Contraindications.—1. Intracapsular extraction should not be performed, because in a large percentage of cases there is luxation into the vitreous.

2. All complicated cataracts due to previous iritis, iridocyclitis or cataracta complicata where the posterior capsule is also involved in the cataractous process or when the posterior capsule has been perforated.

This was very forcefully demonstrated in the case of W. U., aged 19, who suffered a perforating injury to the eye due to an intraocular piece of steel. Within two weeks the acuity was reduced from 20/30 to 20/200, owing to a traumatic cataract. At the time of removal of the traumatic cataract, in May 1954, the procedure was complicated by adhesions to the cataract from the injured posterior capsule. This made delivery of the lens very difficult. It was because of this fact that I decided not to replace the traumatic cataractous lens with an acrylic lens.

Six months later there occurred a detachment of the retina. This justified my judgment in not placing an acrylic lens within this eye.

3. Children with cataracts (various forms of congenital or traumatic) under the age of 12 should not have an acrylic lens.

4. Eyes with intraocular tension within the higher limits of normal are prone to secondary increased intraocular tension. Prophylactic treatment of such eyes with pilocarpine is advisable.

REPORT ON PATIENTS STUDIED AND FOLLOWED FOR ONE TO THREE YEARS

In the following synopsized report are presented the cases of 13 patients who were surgically treated for cataract, with use of the Ridley acrylic lens:

1. R. U., aged 34:
   Diagnosis, left traumatic cataract at the age of 13.
   3/11/53 Left cataract extraction (extracapsular) with acrylic lens implant.
   4/17/53 *Right Vision:* 20/200
   —3.00 + 0.50 axis 40 = 20/20
   Left Vision: 20/200
   —6.75 + 1.00 axis 150 = 20/25
   5/17/55 At Nurnberg, Germany: Pupil mobile and centrally located; binocular vision.
   Right Eye: —4.75 + 1.00 axis 75 = 20/20 Jaeger No. 1
   Left Eye: —6.25 + 1.00 axis 105 = 20/25 Jaeger No. 1 slowly
2. A. B., aged 45:
   Diagnosis, presenile cataracts in both eyes of two years' duration.
   Right Vision: 20/100 No Jaeger
   Left Vision: 20/300 No Jaeger
   9/30/53 Left cataract extraction (extracapsular) with acrylic lens implant.
   Left Vision: 20/50
   +2.75 + 2.25 axis 172½ = 20/25 + 2
   2/17/54 Right cataract extraction (extracapsular) with acrylic lens implant.
   Right Vision: 20/80
   +3.75 + 0.75 axis 20 = 20/20 —3
3. C. H., aged 68:
   Diagnosis, senile bilateral cataracts with slight increase in intraocular tension in both eyes, controlled with miotics.
   9/23/53 Right cataract extraction (extracapsular) with acrylic lens implant.
   Right Vision: 20/200
   —9.25 + 6.00 axis 27 = 20/15
   Left Vision: 20/200
   —6.00 + 4.00 axis 105 = 20/200
4. W. A., aged 49:
   Diagnosis, presenile cataracts in both eyes.
   5/22/53 Right cataract extraction (extracapsular) with acrylic lens implant.
   Right Vision: 20/200
   —6.00 + 2.00 axis 180 = 20/25 —3
   7/14/54 Left cataract extraction (extracapsular) with acrylic lens implant.
   Left Vision: 20/100
   —7.50 + 1.00 axis 2½ = 20/30 + 2
5. J. M., aged 30:
   Diagnosis, traumatic cataract in the left eye with multiple foreign bodies embedded in the cornea and on the anterior surface of the iris at 5, 6 and 7 o'clock. Calcareous changes in the anterior capsule.
   4/27/53 Iris adhesions severed at 6 o'clock. After the use of a sharp cystotome, the calcareous capsule was removed with capsule forceps, the calcareous lens removed and the remnants thoroughly irrigated. There were some adhesions on the temporal side of the iris, but this did not prevent placement of the acrylic lens.
   Right Vision: 20/80
   + 1.50 + 4.00 axis 100 = 20/20
   Left Vision: 20/50
   — 3.25 + 1.50 axis 140 = 20/20
6. M. T. S., aged 55 (Negro):
   November, 1952
   Diagnosis, right cataract extraction (extracapsular) with acrylic lens implant.
   Right Vision: 20/80
   + 2.00 + 3.00 axis 180 = 20/20
   Left Vision: 20/50
   + 2.00 + 2.00 axis 180 = 20/25
7. W. B., aged 65:
   Diagnosis, bilateral senile cataracts.
   10/7/53 Left cataract extraction (extracapsular) with acrylic lens implant.
   Left Vision: 20/100
   Plano + 2.00 axis 60 = 20/80 — 2
8. A. W., aged 22:
   Diagnosis, diabetes since the age of 10. Utilized 40 units of insulin for past eleven years.
   A true juvenile (18 to 25 years) diabetic cataract is not a contraindication, even though the posterior capsule may be partially involved in the cataractous process, particularly if the diabetes is well controlled and the patient is properly prepared medically.

This patient had a true diabetic cataract, as characterized by widespread and subcapsular changes, especially in the posterior cortex. These changes were bilateral and ran a relatively acute course. The cataract contained vacuoles interspersed with fine punctuate and flaky white precipitates, water clefts and separation of the sutures.

8/12/53 Left cataract extraction (extracapsular) with acrylic lens implant.
Left Vision: 20/80
— 3.25 + 2.75 axis 20 = 20/30
There was no undue reaction from the acrylic lens. The pupil is round and centered and mobile. There are no pigmentary exudates on the lens surface.

10/13/54 Right cataract extraction (extracapsular) with acrylic lens implant.
Subconjunctival injection—
Hydrocortone, 2.5%
Right Vision: 20/60
+ 0.25 sphere..... = 20/25

9. B. P., aged 43:
Diagnosis, bilateral cataracts.
8/25/54 Left cataract extraction (extracapsular) with acrylic lens implant.
Left Vision: 20/100 — 2
— 1.75 + 2.00 axis 65 = 20/30 — 3

FAILURES AND THEIR EXPLANATIONS

1. C. H., aged 68:
Nine months from the time an excellent immediate result had been obtained (vision improved 20/15), after a long automobile trip, the patient suffered complete dislocation of the lenticulus into the dependent portion of the eye. Its movement is slight and occurs only with extreme movement of the eye downward.
At first, the intraocular tension became elevated. This is now controlled readily with 2 per cent pilocarpine solution.
The aphakia is now convertible with the following formula: + 6.50 — 3.75 axis 22 equals 20/15: Add + 2.50 equals Jaeger No. 1 at 16 inches. The lens has been well tolerated and has produced no further signs of irritation.
This patient laments the loss of "normal" ocular function — normal peripheral fields. Use of the naked eye for shaving, etc., and the many other functions he possessed with the acrylic lens, even though at the time of writing his visual acuity by the usual standards is again 20/15 with Jaeger No. 1 at 16 inches.

2. W. B., aged 65: Exudate on the anterior lens surface and excessive iris pigment have produced dense posterior synechiae and reduced unaided vision to 20/100. Vision is not improved with a refraction.
In retrospect, I am convinced that (a) irrigation was not done as thoroughly as necessary after insertion of the lenticulus and (b) homatropine was not instilled early enough, and 10 per cent neosynephrine produced no effect on the synechiae.

3. A. A., aged 51:
12/52 Right cataract extraction (extracapsular) with acrylic lens implant.
February, 1953
Right Vision: 20/50
— 2.00 + 1.75 axis 150 = 20/25
Left Vision: 20/50 + 2
— 1.75 + 1.75 axis 5 = 20/15 — 1
The anterior lens surface was clear, but inferior temporal portion of the iris impinged on the groove of the lens. In April it was decided to separate these adhesions on the lens groove with a sharp spatula, but the adhesions proved very dense and difficult to separate. In October the proliferative membrane over the lens surface had become dense with secondary glaucoma and edema of the corneal epithelium and stroma. Vision was reduced to finger counting at 1½ inches. In November the pupillary portion of the dense membrane was incised and excised. The central portion of the lens was clear. At the time of writing the corneal edema is absent and the intraocular tension normal.
Right Vision: 20/200
With pinhole 20/80
Comments.—This demonstrated to me that if the posterior capsule is uninjured and the lens properly centered, the dense fibrous tissue formed even after three to four months is so firm that it is practically impossible to separate the acrylic lens from its enmeshment in fibrous tissue. *In retrospect,* my judgment was faulty, because the lens would not have been dislodged even though the iris at 6 o'clock had become attached to the groove of the lens.

4. O. A., aged 59:
Diagnosis, senile cataract of left eye.
This patient was operated on elsewhere. She stated that during removal of the corneoscleral sutures "some water ran out of the eye." The anterior chamber was lost and dense anterior synechiae formed, with obliteration of the anterior chamber from 12 to 3 o'clock and secondary glaucoma associated with corneal edema.

CONCLUSION

Although the Ridley lens may not be the final answer to the problem of aphakia, it is certainly an ingenious step toward attainment of the desiderata: single binocular vision, good peripheral vision and useful vision without glasses.

With further improvement in the manufacture of the acrylic lens, so that the specific gravity of the lens (now 1.9) is equal to that of the aqueous (1.03), dislocation of the lens will be practically eliminated.

Farther on the horizon I can see the time when these lenses will be ground according to the specific dioptic needs of the aphakic patient.

ZUSAMMENFASSUNG

Der Verfasser berichtet üben den augenblicklichen Stand der Technik mit der Ridleyschen Akryl-Linse. Er beschreibt die zu ihrer Einsetzung notwendigen Handgriffe und führt die Indikationen und Gegenindikationen an. Die Arbeit enthält einen Bericht über eine Gruppe von Kranken, die ein bis drei Jahre lang nachuntersucht wurden.

SUMÁRIO

O Autor discute a lente intra-ocular acrilica de Ridley, bem como a operação necessaria para aplica-la, incluindo algumas modificações neste processo. São apresentadas asindicações e contra-indicações, bem como 12 casos, em 3 dos quais houve falha do tratamento. O A. explica estas falhas com base em sua experiencia e apresnta suas recommendações quanto ao tratamento dos pacientes.

RIASSUNTO

L'autore descrive l'impiego della lente acrilica intraoculare di Ridley con qualche modificazione sul metodo originale. Ne elenca indicazioni e controindicazioni e riferisce su 12 casi personali con 3 insuccessi. Questi ultimi vengono giustificati.

RÉSUMÉ

L'auteur parle de la lentille acrylique intraoculaire et de l'opération spéciale pour son application. Il y ajoute quelques modifications et il y énumère les indications et les contre-indications de cette opération en présentant douze cas opérés parmi lesquels trois étaient un échec.

L'auteur fait une analyse de ces échecs opératoires et il fait, en se basant sur son expérience, des recommandations concernant la manière de traiter ces patients.

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Orthopedic Surgery

Flat Feet and Lateral Rotation of Legs in Young Children

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MANY articles have been written on the treatment of flat feet. Little has been written about their prevention. Present-day medicine and surgery are as much concerned with the prevention of disease and disabilities as with the cure. If flat feet are to be prevented, the cause must be known.

There is a small group of cases in which the flat foot deformity is truly congenital. In these one encounters severely deformed feet, which look almost like reversed club-feet. The talus points medially and toward the sole. This deformity, like other congenital deformities, is present at birth and is easy to diagnose, but it is very difficult to correct. This type will not be considered here.

This paper will deal with the large group of flat-footed children who are seen daily by pediatricians and by orthopedists interested in children. The mother notices, when these children begin to pull up and stand, that the feet turn outward and have no arches. It is usually assumed that such children have inherited flat feet from one or both parents and that nothing could have been done to prevent it.

Not all children are flat-footed. Some children have normal feet, and still others are pigeon-toed. Children brought for treatment usually fall into one of two patterns: One group has "medial torsion of the legs" and is pigeon-toed; the other has "lateral torsion of the legs" and is flat-footed.

Etiologic Factors. — During the first four months of life, when the baby cannot turn over, he may spend most of the time in the same position. Both of the aforementioned groups sleep on the abdomen. The babies with medial torsion and pigeon-toe deformity sleep in the knee-chest position, with their knees drawn up under them and their hips up in the air. The weight comes on the feet, which are turned in. At other times they may sleep with the legs extended, but with the feet turned in. Babies with lateral torsion and flat feet sleep on the abdomen with their legs abducted 90 degrees into a frog or "spread-eagle" position. The babies who alternate and sleep in both positions may have normal rotation of the legs and normal feet.

The fetus, which has been floating in amniotic fluid before birth, is placed after

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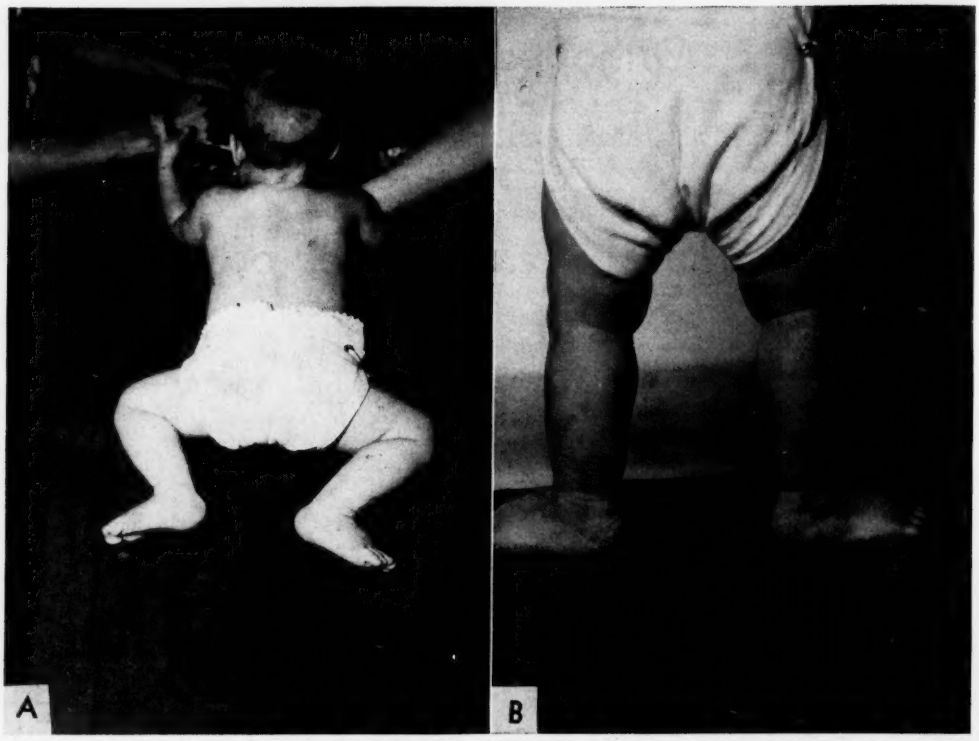

Fig. 1.—*A*, baby placed in frog position. In this attitude the legs are rotated laterally ninety degrees. The great toe rests on the mattress forcing the forefoot into abduction. Sleeping constantly in this position produces lateral rotation of the legs and flat feet. *B*, characteristic standing position of the child shown in *A*. There is fixed lateral rotation in the hips, so that the patellas and toes point outward nearly ninety degrees.

birth on a firm mattress. A new, stiff and much too large diaper is applied, holding the legs in abduction, almost like the pillow used in the treatment of congenital dislocation of the hips. If the baby is placed on either his abdomen or his back, the legs are abducted to a right angle with the trunk. The knees are flexed, rolling the legs laterally 90 degrees at the hips (Fig. 1*A*). The anterior surface of the thigh is not in line with the anterior surface of the abdomen, as it would be if the legs were in full extension. The anterior surface of the thigh is rolled outward 90 degrees, and the medial surface of the thigh is on the mattress. As the months go by, the ligaments about the hip become contracted and hold the legs in this laterally rotated position.

This position also causes certain changes in the feet. The great toe rests on the mattress, turning the fore part of the foot out in abduction. The fore part is abducted as far as it will go in the midtarsal joint, and then it pulls the posterior portion of the foot out in eversion. There is no paralysis of the muscles of the leg, but the peroneal muscles gain strength by being in a shortened position. They pull in a direct line, which gives them a mechanical advantage. The tibial muscles are slightly weakened by being stretched. They work at a mechanical disadvantage by having to pull from around the corner. The foot is more

frequently pulled out and upward in a calcaneovalgus position. The fore part of the foot may be actively adducted to the midline but is not inverted as strongly as it is everted. It seems logical to assume that this froglike position maintained day and night for the first four months and often for months longer, is the chief cause of lateral rotation of the legs and flat feet.

The baby old enough to sit who sleeps in a knee-chest position will flex his knees and sit back on the lower parts of his legs, with his feet turned in. If he has outward rotation of the legs he will sit tailor fashion, with his thighs still rotated laterally.

When the child who has slept in the frog position is old enough to pull up and stand, the legs are each rotated laterally, so that the patella as well as the toes point outward about 90 degrees. It might be said that "one foot goes east and one goes west" (Fig. 1*B*). The child will walk with his legs rotated half way between the limits of lateral and medial rotation. Therefore, he will place his feet in about 45 degrees of abduction.

Rotation Test. — If one examines the baby while he is lying on his back, one can tell which way he has slept during his early life. This is done by grasping the legs near the knees and rolling the legs medially and laterally. If he has slept in all positions, the patellas can be turned medially and laterally about the same distance from the midline. If he has slept in the knee-chest position, the patellas can be turned medially 90 degrees but cannot be turned outward much past the midline. If he slept in the frog position, the patellas can be rotated laterally at least 90 degrees (Fig. 2*A*) but cannot be rotated medially much past the midline (Fig. 2*B*). The limitation to rotation is in the

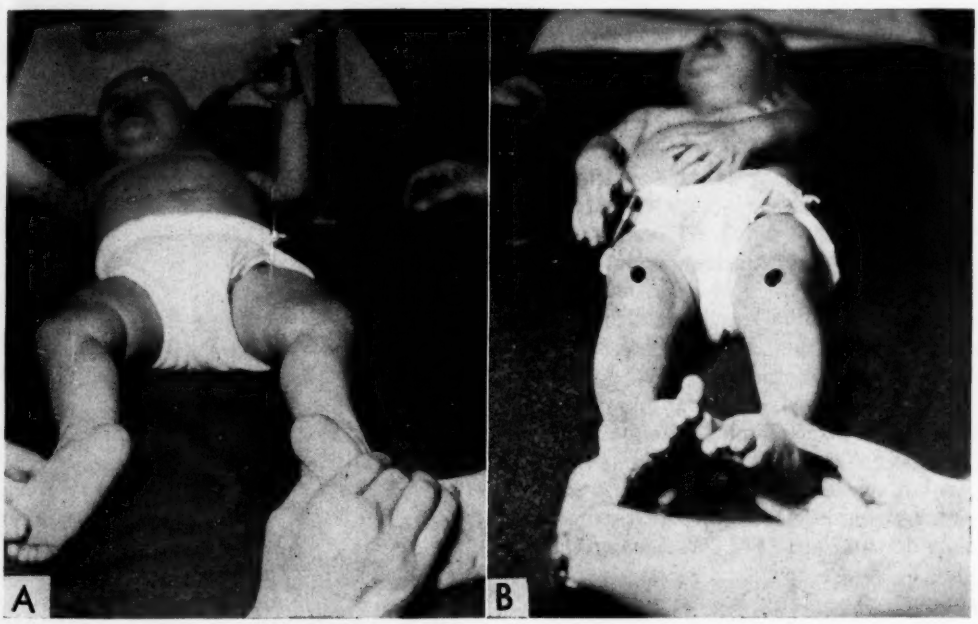

Fig. 2.—*A*, rotation test. This same child's legs can be rotated laterally in the hips more than 90 degrees, so that patellas and toes point outward. *B*, same child's legs are rotated medially. When this is done, they can be turned in until the patellas point straight forward, but cannot be forced inward any further.

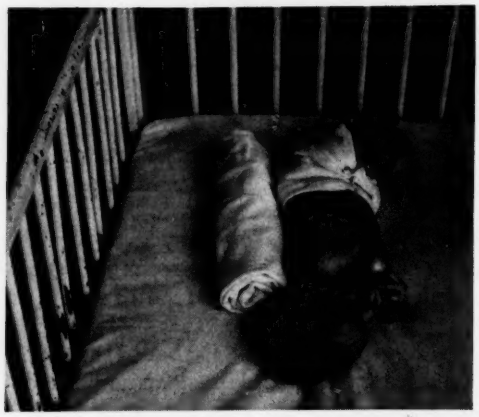

Fig. 3.—Baby encouraged to sleep on his side by placing a rolled up baby blanket as a support against his shoulder and hip.

hips and is due to contracture of the ligaments about the hip joint.

Prevention of Flat Feet — If this theory is correct, flat feet in many cases are produced by the position in which the baby has slept, this deformity can be prevented by keeping him from sleeping in the same faulty position all of the time. The best position for sleep, as far as rotation of the legs is concerned, is on the side (Fig. 3). When the baby lies on his side the anterior surface of the thigh and the anterior surface of the abdomen are in the same plane. This is true for the upper part of the leg as well as for the lower.

After the child has been sleeping for some time in the same position, this becomes his "position of comfort," and he dislikes to change positions. If he is started sleeping on his side immediately after birth he does not have to make the change. He can be encouraged to sleep on his side by placing a pillow or support against his shoulder and hip (Fig. 3). A baby blanket may be rolled up like a log and used as a support. The baby is changed from side to side after each feeding.

Treatment. — Formerly, when these children were old enough to walk and it was noticed that they were flat-footed they were ordered "swung-in" shoes, which were expected to correct the deformity. It was only in cases of very mild involvement that the swung-in shoes were successful. It was evident that something more was needed if these children were to walk with their toes pointing straight forward.

For the past seven or eight years I have been carefully teaching mothers to do two things, which I have found to be very helpful. Since lateral rotation of the legs is due to a fixed contracture of the ligaments about the hip joint, one cannot expect the child to overcome this lateral rotation by simply applying a shoe that holds the forefoot in slight adduction. The mothers are first taught to grasp the child's knees and to rotate his legs medially in the hips, as far as they will go com-

Fig. 4.—Lateral rotation is treated by having the mother grasp the knees and rotate the legs medially as far as they will go comfortably, and to hold them in this position for half a minute. After a few seconds rest, this procedure is repeated

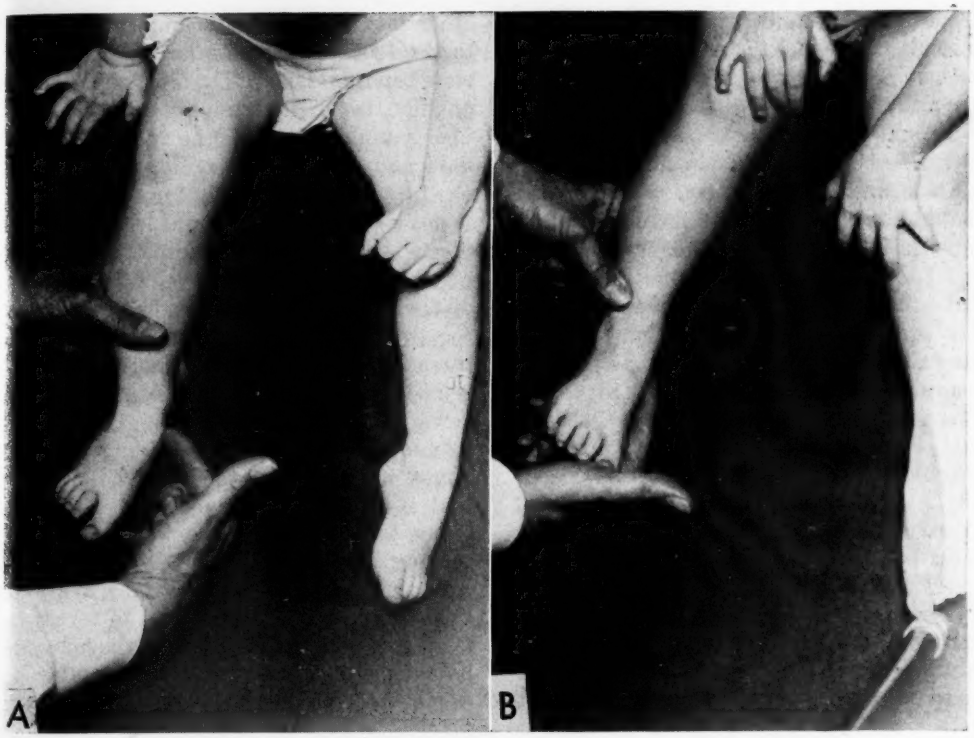

Fig. 5.—*A*, a good way to hold the foot to treat the flat foot deformity is to begin by placing the index finger on the tubercle of the navicular. *B*, the ball of foot resting on the mother's flexed third finger.

fortably, and to hold them in this position for half a minute (Fig. 4). They are encouraged to count slowly to thirty. They are told that there is no virtue in the number thirty, but that there is virtue in holding the hips stretched medially for a long time. It seems that a long stretch does more good than a few short wiggles of the leg. The leg is released for a few seconds of rest and the stretching repeated. It is passive stretching and not active exercise. Several minutes are spent doing this.

The second procedure is to treat the flat-foot deformity. The mother is shown how to hold the fore-part of the foot and the heel, so as to turn the forepart down in plantar flexion and in adduction, and how to invert the heel and restore an arch to the foot. This turns the foot farther in than does the swung-in shoe and also farther than the child does in his movements of the foot. The success of this procedure depends entirely upon how well the doctor teaches it to the mother. The doctor should determine by trial and error the best way to hold the foot, and then teach this to the mother in the easiest way for her to learn. After teaching this procedure to about 500 mothers, I have found the following method to be good.

Since most mothers are righthanded, it is easier to start with the right foot first. With the child on his back on the examining table and the mother facing the feet, she begins by placing the index finger

of her right hand on the tubercle of the navicular bone (Fig. 5*A*). This is described to her as a pea-shaped bone on the medial side of the foot, halfway between the base of the great toe and the heel. If the forefoot is in abduction she can see and feel it better. If she is in doubt about having the finger on the right bone, she can move her finger backward and forward, and feel the finger slip off and on the bone. With the index finger on this bone, the flexed third finger is under the ball of the foot (Fig. 5*B*). The thumb comes on top of the great toe (Fig. 6*A*). This gives her a good grasp of the forepart of the foot. The child's heel is placed in the middle of the palm of the left hand, and a firm grasp is taken on the heel (Fig. 6*B*). The middle finger of the left hand is placed on top of the tip of the index finger of the right hand, giving a little more pressure on the tubercle of the navicular (Fig. 6*C*). With gentle but firm pressure she inverts the heel, carries the forepart of the foot inward toward the other foot, and restores a longitudinal arch to the foot. She bends the foot as if she were bending a wire. The foot is held in this position for half a minute and released. She is taught to push the tubercle of the navicular bone straight into the side of the foot and not upward. In correcting flat feet by casts, I have found that the correction can be obtained more quickly when pressure is made on the side of the tubercle of the navicular bone, pushing it into the foot, rather than by pushing upward on the navicular bone. The mother is cautioned not to turn the foot loose, thus rewarding the child for struggling, but to be gentle and to continue holding the foot. After a little while the child will realize that it does not hurt and that he is not going to get loose. He will then let his mother hold the foot without too much objection. She is urged to make it a part of the daily routine, so as not to forget it. It may be done when she gives the baby his bath or puts him to bed. The mother is asked to spend ten minutes by the clock

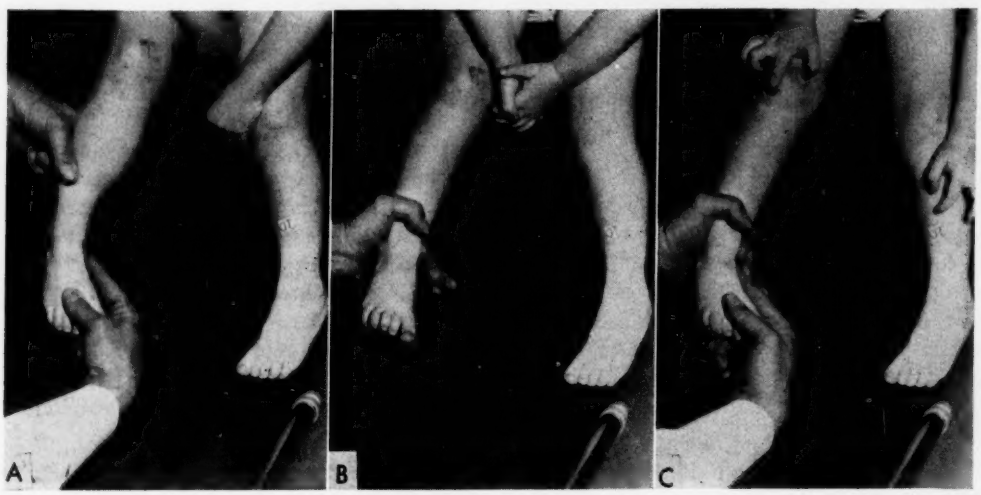

Fig. 6.—*A*, thumb is placed on top of great toe, giving a good purchase on the forefoot. *B*, heel placed in the palm of the other hand and a firm grip is taken on the posterior part of the foot. The heel should also be inverted to correct the valgus deformity. The third finger is raised to press on the top of the index finger, when the two grips are combined. *C*, when the two grips are combined, the forefoot is adducted, and pressure is made inward on the tubercle of the navicular, thus shifting the talus from a flatfoot position on the medial side of the foot to the lateral side of the foot.

twice a day on these three procedures, or about three minutes on the knees and the same on each foot. She is told that this stretching is the important part of the treatment.

Shoes. — Shoes are of secondary importance. They should be one of the many kinds of "swung-in" shoes on the market today. Years ago corrective shoes could be obtained only by being made to order. Today most of the large shoe manufacturing companies have a "corrective" shoe. They all have about the same features: The forepart of the foot is swung in, there is a long medial counter, and a Thomas heel with a lift of ⅛ inch (0.32 cm.) under the medial border. Some makes of shoes are heavier than others. The lighter shoes are better for the first pair and until the child begins to walk well. Then a little heavier shoe can be ordered. Some shoes are swung in more severely than others. For girls a medium-weight shoe is used. For boys and over-weight children the heaviest shoe is used.

A lift of more than ⅛ inch under the heel puts a strain on the ankle and foot and is not recommended for young children. I am very much opposed to a lift under the "little toe side" of the sole. This everts the lateral side of the forepart of the foot, depresses the arch, and throws the foot into a flat-footed position.

New shoes should be broken in gradually. If they are worn constantly, pressure may cause red spots on the foot and occasionally a blister. Failure to observe this point has caused some mothers to discard the corrective shoes. There is no virtue in high-topped shoes, except that they are more difficult for the child to remove. As soon as the manufacturers make corrective oxfords in the smaller sizes, they may be worn. When the child becomes older, he should be taught how to walk with his feet pointing straight forward and should be trained in the many exercises that correct flat feet.

About 90 per cent of feet will respond to the aforedescribed treatment when it is carried out regularly. For children who still toe out and children whose mothers will not stretch the feet, a bar can be placed across the shoes and worn at night to roll the legs medially. The bar should be bent toward the body to invert the ankles slightly. For the older child who still has a flat foot imprint, a rubber or metal arch support may be placed inside the shoe. I think of these as crutches and use them only in the cases of severe deformity that has not responded to the treatment described. My preference is for the metal support manufactured by the brace maker.

The patient returns for observation every three months. New shoes will be needed by this time. The mother is again checked as to her method of stretching and given further instructions as to how to do it more efficiently. When the child begins to wear the heels off more on the lateral border, he is approaching the time when he may have a shoe with no lift under the heel. He should not go barefoot until he walks with the feet straight, has a normal longitudinal arch when he stands and a normal imprint. Most children who have followed this routine will have normal feet by the third or fourth year. There are some extremely flexible or hypermobile feet that will always collapse into a flat-footed position. These should be held for a longer period, and later in life, if the foot is painful, an operative procedure may be needed.

SUMMARY

Lateral rotation of the legs and flat feet in a small child are caused by the child should sleep in various positions, in the frog position. To prevent this the child should sleep in various positions. preferably on his side. When the deformity is present, the lateral rotation is treated

by rolling the legs medially. The flat-foot deformity is corrected by stretching the fore part of the foot downward to restore the longitudinal arch to the foot. This is supplemented by swung-in shoes.

RÉSUMÉ

La rotation latérale des Jambes et les pieds plats des petits enfants sont causés par la coutume de l'enfant de dormir constamment sur l'abdomen dans la position grenouille. Pour prévenir cela l'enfant devait dormir en différentes positions, préférément sur le coté. Si la deformité est présente, la rotation latérale est traitée en tournant les jambes médialément. La deformité des pieds plats est corrigée en étendant la partie antérieure du pied en bas et en dedans pour restorer la voûte plantaire du pied. Cela est supplémenté par des souliers tournants en dedans.

RIASSUNTO

La rotazione laterale della gamba e il piede piatto, nei bambini piccoli, sono il risultato del fatto che essi dormono sempre sull'addome, nella posizione della rana. Per evitare questo inconveniente bisogna farli dormire in una posizione diversa, preferibilmente sul fianco. Quando la deformità si è stabilita, la rotazione della gamba deve essere trattata girandola all'interno, mentre il piede piatto viene corretto stirando la parte anteriore del piede in basso e all'interno per ristabilire l'arco logitudinale del piede.

ZUSAMMENFASSUNG

Aussenrotation der Beine und Plattfüsse bei kleinen Kindern entstehen dadurch, dass das Kind ständig auf dem Bauche mit angezogenen Beinen (Froschschenkellage) schläft. Um solche Deformierungen zu vermeiden, sollte man die Kinder in verschiedenen Lagen, am besten auf der Seite, schlafen lassen. Ist die Entstellung bereits eingetreten, so wird die Aussenrotation durch Einwärtsdrehung der Beine behandelt. Der Plattfuss wird durch Streckung des Vorderteils des Fusses nach unten und innen korrigiert, wodurch eine Wiederherstellung des Längsgewölbes des Fusses angestrebt wird. Als unterstützende Massnahme werden einwärts gedrehte Schuhe verordnet.

SUMÁRIO

A rotação lateral das pernas e pés planos numa criança pequena são provodados pelo fato da criança dormir frequentemente sobre o abdomen, na posição de rã. Para evitar tal fato, a criança deveria dormir em varias posições, preferentemente de lado. Quando a deformidale existe, a rotação lateral é tratada promovendo-se a rotação das pernas medialmente. A deformidade do pé plano é corrigida forçando-se a parte anterior do pé para baixo e para dentro, para restaurar o arco longitudinal do pé, utilizando-se ainda sapatos adequados.

Men are wise in proportion not to their experience but to their capacity for experience.

—*Shaw*

Fractures of the Legs: Clinical Use of Alloplastic Bone Graft

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An earlier paper has described the use of a mixture of gelatin, formaldehyde and mineral salts to be of value experimentally in stimulating bone healing in animals. Briefly, the alloplastic material consists of the organic and inorganic fractions of bone. When formaldehyde is added to the mixture it solidifies and hardens (Fig. 1).

This material has now been used in the long bones and spines of 6 patients: 1 with established nonunion, 3 with delayed union, 1 with a fresh fracture and 1 with spondylolisthesis treated with an H graft of autogenous bone.

REPORT OF CASES

CASE 1.—J. W. B., a man aged 52, incurred an injury to the left leg on May 29, 1952, when it was struck by a metal pipe. The distal shafts of the tibia and fibula were fractured. Treatment elsewhere consisted of plaster cast immobilization plus Steinmann pins both above and below the fractures. After one month infection developed around the lower pin. The plaster and pins were removed and then replaced by a splint. A plaster cast was worn subsequently for two months.

He was first seen by us six months after the injury. Roentgenograms revealed established nonunion of a spiral fracture through the distal shaft of the tibia (Fig. 2). Weight bearing was painful, so that crutch support was required for ambulation. On Dec. 7, 1953, operation was performed. The fibula was first osteotomized, and then the tibial fracture was exposed. Scar tissue at the fracture site was excised and the bone curetted, the medullary cavity also being opened both proximally and distally. Alloplastic material was placed into the medullary cavity and externally about the fracture site. A single steel screw was placed across the fracture for internal fixation, and a long leg plaster was applied. Three weeks after the operation, when sutures were removed through a window in the cast, the wound drainage included some of the alloplastic material.

Two months after the operation the plaster was changed, and the operative wound was observed to be well healed. Immobilization was continued for a total period of nine months, at the end of which time the steel screw was removed and a short leg caliper brace fitted.

Roentgenograms were taken at monthly intervals. Bony union was apparent clinically and roentgenographically one year after the operation (Fig. 3). The patient was able to walk without cane or crutches. Some discomfort in the ankle, which is stiff, is now present after long walking.

CASE 2.—L. J. S., a 29-year-old man, sustained a compound fracture of the upper third of the left femur in a motor accident on April 17, 1953. He was treated elsewhere by im-

Fig. 1.—Pieces of alloplastic material. No porosity is produced by vigorous beating of the material during its preparation.

Submitted for publication Aug. 4, 1955.

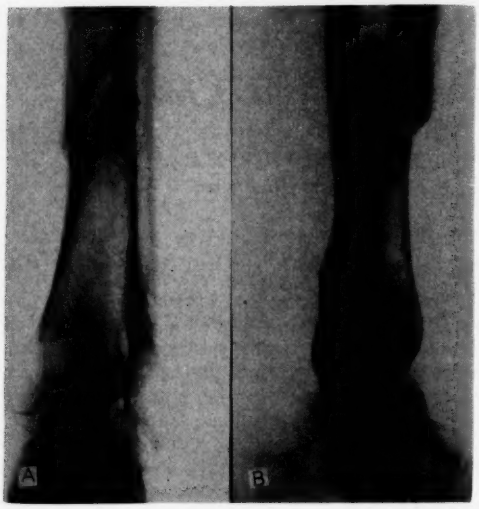


Fig. 2 *(Case 1).*—Preoperative anteroposterior and lateral views of the left leg of J. W. B., showing obvious nonunion of a spiral fracture of the tibia, with sclerosis at the ends of the fractured bone. Note also the osteoporosis distal to the fracture.

mediate open reduction and fixation with a steel plate and screws. Postoperative treatment consisted of skeletal traction for four months, followed by an ischial weight-bearing long leg brace.

When the patient was first seen by us, about five months after the injury, the fracture had not united and the plate was markedly angulated (Fig. 4). On Sept. 12 operation was performed, consisting of removal of the plate and screws, curetting of the fracture site and intramedullary nailing. Pieces of alloplastic material were placed around the fracture site (Fig. 5*A*).

Gradual weight bearing with crutches was begun three weeks after the operation. Excellent callus formation was noted on the roentgen film within two months. This progressed to solid bony union and consolidation (Fig. 5*B*).

The nail was removed on June 16, 1954, no complications being observed.

CASE 3.—L. B., a 15-year-old girl, was involved in a motor accident on Aug. 10, 1954, and sustained a compound fracture of the middle third of the right femur. Operation was performed elsewhere on Aug. 16 and consisted of open reduction and fixation with a steel plate and screws. Postoperatively a plaster cast hip spica was worn for two months. This was followed by three weeks of confinement to bed, exercises and then gradual ambulation on crutches, with no weight bearing on the right lower extremity. Consecutive roentgenograms revealed partial union on the medial side but a state of delayed union on the plated side of the fracture (Fig. 6*A*).

On Feb. 3, 1955, operation was performed. The metal plate and screws were removed, scar tissue was excised, and onlay grafts of alloplastic material were placed over the fracture. Six weeks of complete bed rest followed. Crutch walking was then resumed, with no weight bearing on the right lower extremity. For ten days a small amount of drainage (clear serous material) took place through the upper part of the wound. Follow-up roentgenograms showed presumptive callus formation within six weeks after the operation (Fig. 6*B*).

CASE 4.—E. W., a woman aged 25, incurred a severe twisting injury to the right ankle on Aug. 22, 1953. At another hospital a plaster

Fig. 3 *(Case 1).*—*A*, postoperative anteroposterior view of the left leg of J. W. B. fourteen months after use of alloplast. There is apparent bony union across the tibial fracture. *B*, later lateral view of the left leg, showing probable bridging of the gap with bone. Posteriorly and superiorly, where the alloplastic material was packed, the bone or callus is abundant.

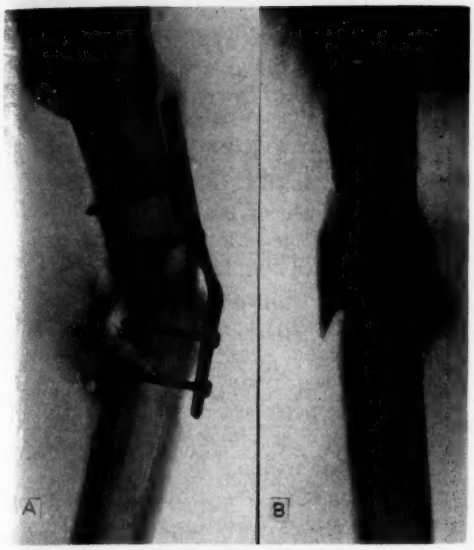


Fig. 4 *(Case 2).*—Anteroposterior and lateral views of the left femur of L. J. S., showing delayed union and angulation of the plate five months after the injury.

cast boot was applied. Roentgenograms revealed a trimalleolar fracture with poor contact of the fracture of the tibial malleolus.

The plaster was removed on Oct. 12, and operation was performed ten days later. The medial malleolus was exposed, and fibrous tissue was curetted from the fracture site. Alloplastic material was then placed between the freshened bony surfaces, and internal fixation was obtained with a stainless steel screw. A plaster cast boot was applied and maintained in place for a total period of eight weeks, weight bearing being allowed during the last three. The patient was last seen on Jan. 6, 1954, before leaving the city. The operative wound was well healed, and roentgenograms revealed the fracture in good position. Ankle motion was good and weight bearing painless.

CASE 5. — C. M., a 35-year-old man, was thrown off a moving railroad car and sustained injuries to the lower part of the back on June 17, 1953. Roentgenograms revealed spondylolisthesis, with forward slipping of the fifth lumbar vertebral body on the sacrum. Pain in the back, and in the left leg persisted and became increasingly worse.

On Nov. 17 a laminectomy was performed, with complete removal of the fifth lumbar neural arch followed by an H graft of iliac bone. Pieces of alloplastic material were placed dorsally and on both sides of the graft. Postoperative care consisted of bed rest for

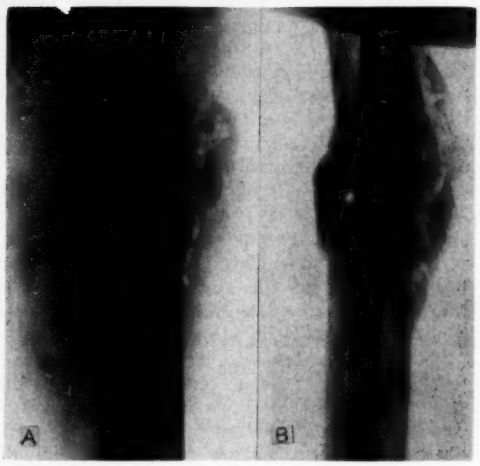


Fig. 5 *(Case 2).*—*A*, lateral view taken on the day of operation, showing intramedullary nail and multiple pieces of alloplastic material anterior to fracture site. *B*, lateral view thirteen weeks after surgery showing large callus anteriorly at site of alloplastic graft.

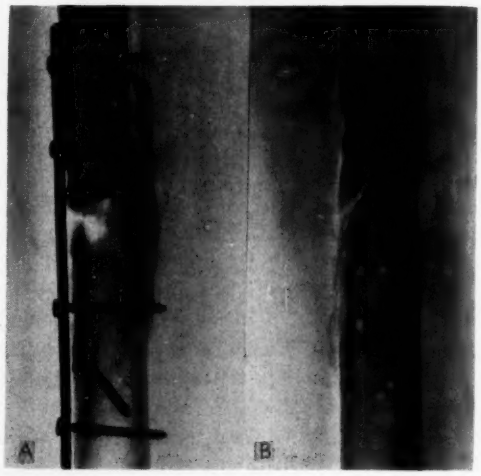
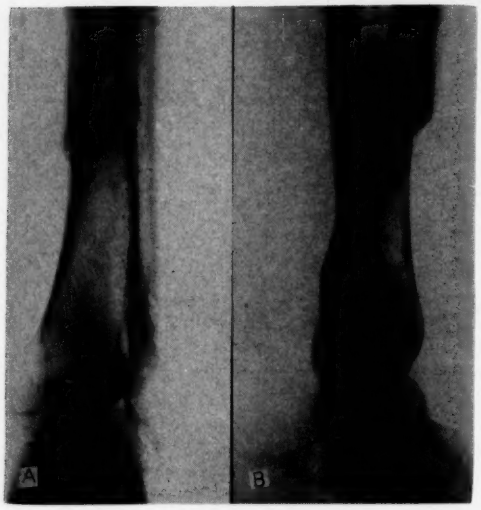


Fig. 6 *(Case 3).*—*A*, anteroposterior view of the right femur of L. B., showing incomplete union six months after previous open reduction. *B*, lateral view showing presumptive callus posterior to fracture site six weeks after removal of plate and screws and the use of alloplastic graft.



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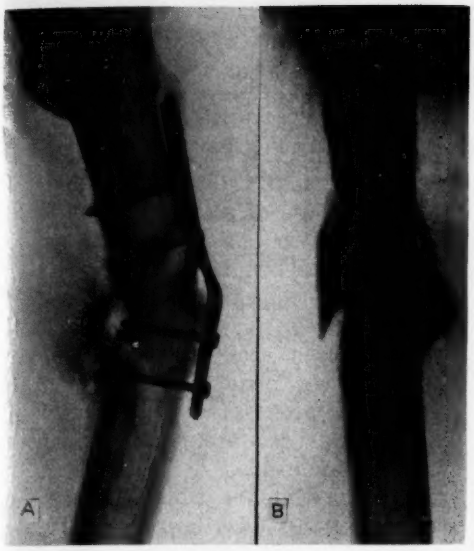

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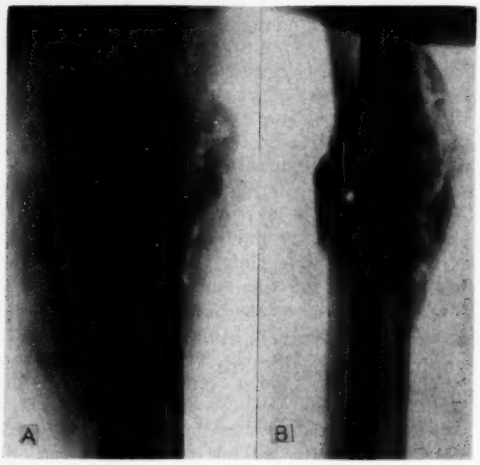

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three weeks, and followed by application of a corset for ambulation. One month after the operation there were no complaints of pain either in the back or in the lower extremities.

CASE 6.—H. B., a man aged 40, fell from a stepladder at home, on Mar. 7, 1954, with resultant pain, swelling, tenderness and deformity of the injured left forearm. Roentgenograms revealed comminuted fractures of the proximal shafts of the radius and ulna, the former without apposition. Closed reduction was attempted without success.

On Mar. 9, open reduction was performed. A Steinmann pin was driven down the ulnar shaft, and the radius was fixed with four screws and a steel plate. Alloplastic material was placed about the site of fracture of the radius. Seven weeks later the plaster cast was changed and the pin removed.

External fixation was maintained for fourteen weeks. No pain or tenderness was noted, and the operative wounds healed *per primam*. Clinically the bones of the forearm were united.

Follow-up care continued until Aug. 28, after which time the patient moved out of the city. Roentgenograms revealed the ulna to be well united, but the radius had not yet healed.

COMMENT

The alloplastic material has been innocuous in all the cases in which it has been used, thus far. In the first and third cases clear, oderless serous material drained through the operative wound. It ceased, however, within a short time. In both instances preoperative sterilization of the alloplastic material consisted of soaking in solution of formaldehyde for two hours, followed by repeated washings in saline solution. In the 4 other cases the period of sterilization was shortened to 10 minutes, and no apparent untoward tissue reaction occurred.

The established nonunion of the tibia was the result of the initial treatment, with incomplete and interrupted immobilization. Nevertheless, since the scar tissue was excised, alloplastic material placed around the freshened fracture site and a single steel screw inserted, union has taken place. The patient can now walk without crutches, whereas before the operation even partial weight bearing on the extremity was painful.

Delayed union in 2 cases occurred in the femoral shaft. In both instances it followed the use of plates and screws for internal fixation. In 1 case the poorly positioned plate bent; in the other the rigid plate actually appeared to hold the bone ends apart. In these cases alloplastic material, added locally about the fracture site, was used instead of a bone graft. Healing has progressed satisfactorily and probably was accelerated by use of the alloplastic material.

A fracture of the tibial malleolus of over three weeks' duration, with soft tissue interposition, can do better with some device, such as a bone peg, to stimulate union. Rather than add to the trauma by procuring a graft from the tibial shaft, we placed alloplastic material over and within the fracture site, and a steel screw was used to fix the malleolus to the shaft. This method was easier for both patient and surgeon.

In the cases of the lumbosacral graft and fresh fracture of the forearm the alloplastic material was not obviously harmful. Whether or not it stimulated healing we do not know.

SUMMARY

Alloplastic material composed of a mixture of formalized gelatin and mineral salts of bone was used in 6 clinical cases. The pathologic condition varied from established nonunion and delayed union of fresh trauma.

No infections or untoward sequelae resulted from the material in any of these cases. Local serous drainage followed prolonged soaking in solution of formaldehyde. This did not occur when the period of sterilization of the material was shortened

to ten minutes. Formaldehyde was used in the initial preparation of the alloplastic material as well as for its sterilization prior to surgical utilization.

The use of the alloplastic material appeared to stimulate the healing of bones in those conditions in which bone grafts are indicated.

ZUSAMMENFASSUNG

Ein aus einer Mischung von mit Formalin behandelter Gelatine und Mineralsalzen des Knochens bestehendes alloplastisches Material wurde in sechs klinischen Fällen benützt. Die Krankheitsveränderungen schwankten zwischen Versagen der Knochenheilung, verzögerter Heilung und frischer Verletzung.

In keinem der Fälle kam es zu Infektionen oder zu unerwünschten Folgeerscheinungen, die dem Material zugeschrieben werden könnten. Nach lange dauerndem Einweichen des Materials in Formalinlösung kam es zu lokalen Absonderungen seröser Flüssigkeit. Dies liess sich vermeiden, wenn die Sterilisierungszeit des Materials auf 10 Minuten verkürzt wurde. Formalin wurde sowohl bei der ursprünglichen Herstellung des alloplastischen Materials als auch zur Sterilisierung vor der chirurgischen Anwendung benützt.

Die Verwendung des alloplastischen Materials hat in Fällen, wo Knochentransplantationen angezeigt sind, offenbar zu einem Anreiz der Knochenheilung geführt.

RIASSUNTO

In 6 casi è stato usato un materiale alloplastico composto di una miscela di gelatina formolata e sali minerali di osso. Le indicazioni furono: i ritardi di consolidazione, le mancate consolidazioni e i traumi recenti.

In nessun caso si ebbero conseguenze spiacevoli nè infezioni del materiale impiegato. Vi fu soltanto un poco di secrezione locale sierosa in conseguenza del prolungato soggiorno in formaldeide, mentre questo non si vierificò quando il materiale era stato lasciato a sterilizzare per meno di 10 minuti. La formaldeide venne impiegata tanto nella preparazione del materiale alloplastico quanto nella sua sterilizzazione prima dell'impego chirurgico.

Sembra che l'uso di questo materiale stimoli la guarigione delle fratture in tutti quei casi in cui è indicato il trapianto osseo.

RÉSUMÉ

Du materiel alloplastique, composé d'un melange de gélatine formalisée et des sels minéraux des os fut appliqué en 6 cas cliniques. Les conditions pathologiques variaient de non unification établie et unification retardée après un traumatisme récent.

Ni des infections ni suites facheuses résultèrent du matériel dans aucun de ces cas. S'il était immergé trop longtemps dans la solution de foermaldéhyde, du drainage local, séreux en résulta. Cela ne fut plus observé, quand la période de stérilisation fut accourcie à 10 minutes. On se servait de formaldéhyde pour la préparation initiale du matériel alloplastique, ainsi que pour la stérilisation avant l'usage chirurgical. L'usage du matériel alloplastique paraissait de stimuler l'unification des os dans les conditions, ou des greffons osseux sont indiqués.

SUMÁRIO

Material aloplastico, composto de uma mistura de gelatina formalizada e sais minerias de osso foi usado em 6 casos clinidos de afecções varias, desde não união já definida, e união retardada ao trauma recente.

O uso deste material não provovou, em caso algum, infecções ou sequelas desagradaveis. Após colocação do material por

tempo prolongado em solução de formaldeido ocurreu drenagem serosa local. Tal não sucedeu quando o periodo se esterilização do material foi reduzido para dez minutos. A solução de formaldeido foi usado no preparo inicial do material aloplastico, bem como em sua esterilização antes de seu emprego cirurgico.

O emprego do material aloplastic parece terestimulado a cicatrização d ossos naquelas afecções em que são ind cados os encertos osseos.

REFERENCE

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In a farmhouse near Rochester there happened to live a woman with an enormous abdominal swelling which must have weighed an incredible number of pounds. Such masses of tissue grew from a diseased ovary, and by their very bulk and weight often become inconvenient and even dangerous. Daring operations were beginning to venture to remove them. A village doctor named Ephraim MacDowell in Danville, Kentucky, had been the first to perform such a feat successfully.

Dr. William Worrall Mayo arranged to meet a few of his fellow practitioners at the farmhouse one Sunday morning, and he proposed to tackle this unfortunate woman's truly prodigious growth. According to custom no fewer than fifteen other doctors from the neighbourhood had gathered to watch the performance in the farmer's parlour.

Unfortunately, the train bringing Dr. Mayo was delayed, and it was not until some hours later that, full of impatience to get busy with the operation, and with apologies to his medical colleagues for keeping them, he reached the farmhouse. There on the doorstep was his elder son William, who shyly informed his father that he had thought it best to get on with the job, with the help of his brother Charles: that in fact he had removed the tumour and there it was in the family washtub, and the patient was safely in bed, with a calm pulse.

—*Williams*

Plastic and Reconstructive Surgery

The Study and Preparation of Plastics

Laboratory Research and Clinical Application

MILTON C. COBEY, M.D., F.A.C.S.*

WASHINGTON, D. C.

THE term "plastic" is newer than the substance it represents. Bakelite, first used commercially for radio sets and the like, dates backward some forty years. It was used in a bakelite plastic hip mold by Dr. Smith-Petersen in 1926. Unfortunately, it had to be discarded because of the annoyance of the noise it made on walking. The application of the plastic hip mold may be one of the earliest surgical uses of plastic inside the human body. The acrylic plastic mold for replacement arthroplasty of the hip has been used since by many. The Judet acrylic prosthesis for the hip is at least ten years old. Membranes of plastic material interposed between joint surfaces in the knee and elbow have been used. Dr. John Kuhn first used cellophane in the knee joint as a replacement of fascia for arthroplasty of that joint as early as 1938.

Acrylic plastics have been used externally for arm and leg splints, it being possible to alter their shape to conform more or less to the body by simply heating the plastic with hot water. The lucite plastic cock-up splints and Colles' forearm fracture splints have been popular. Lucite finger splints and extremity molds have been available commercially for some time.

It was discovered in the middle thirties that lucite, which is a form of sodium polyacrylate, would transmit light through its long axis. It would carry light around curves in its own configuration. As early as 1940 retractors were made from lucite to be used in the mouth, knee joint and other sites.

Plastics have also been used for other purposes. The self-locking nylon washer is employed in nuts for the Wilson spinal fusion bolts, or for the nut on the McLaughlin trochanteric nail. These have been used inside the body successfully, causing reactions only infrequently. There is a sensitivity factor in the use of nylon, but it is infrequent.

Ivalon sponge is a plastic material that has been used inside the body by both reconstructive surgeons and general surgeons. Its implantation in the breast tissue to alter the configuration of the breast is well known. It has also been used successfully in corrective operations on the face and on the ear. It has met with some disfavor, for after the water is absorbed from it the mass is rough and hard. If the breast tissue is drawn too tight over it in

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the build-up operation, there may be a slough. Ivalon sponge has been tried on dogs and found to be nonirritant. This study of its use in the joint was tried on some 36 dog joints in an effort to find out, first, that the joint would tolerate it, and second, that it would remain soft owing to the action of the synovial fluid. When placed in tissues other than a joint, the material of the ivalon sponge becomes very hard. Water from the sponge, which will necessarily keep it soft for surgical application, is rapidly absorbed. When placed in a joint, however, it remains soft because of the synovial fluid and does not become hard or firm.

When the cartilage is removed from one or both opposing surfaces of the joint, fibroblasts will grow into it, rapidly fixing it into place so that it will not slip. When used as an interposing membrane in a joint, it is held in place by rapid growth of fibrous tissue. The fibrous tissue fixes it sufficiently between the bone ends to obviate the need of sutures. Large cells (macrophages) appear in the interstices of the sponge. These macrophages seem to transpose themselves into chondroblasts, osteoblasts and osteoclasts. If this occurred in tissues other than a joint, where the sponge is bathed by synovial fluid, and early motion were not permitted, bone would be produced. It has been shown that after ivalon sponge has become dry and hard in fractures other than joints, where there is no motion, the same growth of the early chondral and osseous cells will produce bone. *It does not here.* When the sponge is soft and motion is continued the interposition of fibrous tissue is the prominent feature. The ivalon sponge, therefore, acts as an excellent interposing membrane between the joints, permitting free and satisfactory motion. This applies particularly to joints that would become ankylosed or have been ankylosed and are separated to produce mobile joints. The knee joint tolerates a large mass of sponge, cut at the operating table to fit the condyles of the joint, which lie beneath the patella, pre

Fig. 1.—Ivalon sponge in gross section of human knee joint.

Fig. 2.—Identification of fracture site.

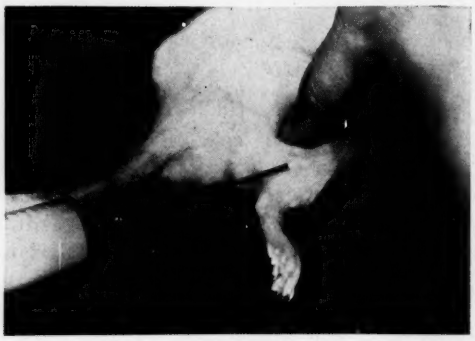

Fig. 3.—Injection made into site of fracture.

Fig. 4.—Gross appearance of fracture site after injection.

Fig. 5.—Microscopic appearance after injection.

venting adherence to these tissues again. This has been done in man as well as in the dog. It was used successfully in hypertrophic arthritic as well as in rheumatoid arthritic joints. No malignant change was observed in any of the dog joints, or in a study of the human joints.

The preformed plastics that have been employed up to this time include bakelite, mylar, fluorothene, nylon, acrylic and several others that can be shaped by heat to make an appliance that will fit over the end of a bone. A plastic material was needed that would "set" without producing heat in polymerization that would burn the tissues. These materials had to be set by cold polymerization; that is, they must not produce heat on polymerizing that would overheat and destroy tissue. Cellulose acetate, the earliest of these and first produced in 1936, could be painted as a covering over plaster of paris casts. Nylon was later described as a strong protective covering. So long as these materials did not crack, the cast would not absorb moisture and remained strong and firm throughout the period of its use. In order that these casts might be so covered they had to be "bivalved" and painted both inside and out.

The development of a new type of plastic known as the melamine resins opens another new field in plastic research. They have a powerful gluing action when mixed with some type of catalyst. The mixing of this material with plaster of paris particles produced a strong bandage. After it had been soaked in water and allowed to set, strong casts could be made—four times stronger than normal plaster—and then would not absorb water or become softened in it. The setting time, either fast or slow, could be controlled and its use as a cast caused no more irritation to the patient than did ordinary plaster. Since there is practically no waste from soaking this plastic in water, there is no damage to basins and buckets. As applied to the patient, it requires one-fourth the number of rolls needed as with the usual hard-setting type of plaster. A successful roll bandage type of plastic for casts was made.

Fig. 6.—Microscopic appearance of foreign body response to plastic.

Efforts are being made in our laboratory at present to work out an internal splint, since we have now perfected an external splint of a cold polymerizing agent. A nontoxic, nonirritant plastic must be created that will form a sufficiently hard mass to adhere to bone ends and hold them together. The plastic must polymerize in the body and produce no heat in so doing. Many compounds have been devised by us and our chemists. The first compound was an already known substance, elvanol, suggested in this work by the British. When elvanol is changed into an acetate emulsion, a fairly firm hard mass is formed that would adhere to the bone ends. This emulsion was injected into the fracture site. It was not found strong enough, however, so it was mixed with a bone salt slurry of calcium carbonate, magnesium oxide, stronsium carbonate, phosphoric acid and citric acid and then buffered to a normal pH solution. The resulting material proved to be much firmer, but still not firm enough to hold the bone ends in good approximation without the necessity of external fixation. The acrylic compounds could not be used, because of their intense heat on polymerizing. Substances such as polyvinyl ethyl methacrylate maleic anhydride with polyvinyl alcohol were tried with dextran and with glycerin. At first, glycol diacetyl thylate in olive oil was thought by some to be good, but it proved decidedly toxic.

It is impossible to list all the compounds that have been tried, but those most successfully used were the cellulose compounds. I observed that Irish moss could be used internally, polymerized with catalysts calcium lactate and calcium phosphate.

By using a two-injection technic, i. e., the sterile cellulose compound in one syringe and the catalytic salt agents, sterilized and buffered, in the other, material could be injected at the fracture site. Otherwise the materials would set solidly in the syringes and injection would be impossible. It was noted that this material would be completely absorbed in four to six months; that it seemed to remain firm for four weeks or longer; that it was nonirritant and nontoxic, and that it had *some* gluing properties. Up to now, this has been my most successful compound.

A lack of sufficient strength of the cellulose mass suggested the protein collagen compounds as they occur in the bodies of animals. By extracting beef collagen in 0.01 per cent acetic acid, pure gelatin could be obtained. This, mixed with one of the salt compounds to be used as a catalyst, produced a nonirritant mass. Although it was not as solid as the cellulose mass, it seemed to have greater power of adhering to the osseous surfaces. Unfortunately, it was hydroscopic and was absorbed in three to seven days. Pure gelatin and beef collagen were tried together, and the same results were obtained. This led to the next step, which is now under development; i. e., the use of gelatin with cellulose compounds and the salts as catalytic agents. In time, with enough experimentation and enough alterations in these compounds, this may prove satisfactory. Research on this has not progressed far enough to justify any final statement. There is hope and just a bit, perhaps, of wishful thinking.

SUMMARY

This paper is a review of the development and use of certain plastic materials during the past forty years. This research work, begun by the author twenty years ago, has in some measure helped to advance the study, development and use of the various plastics. The number of plastics available to the thinking chemist is almost unlimited. The possibilities of plastics for use in orthopedic surgery are also unlimited, and the future of their use in

surgery in general appears likely to become an important development in medicine.

ZUSAMMENFASSUNG

Die Arbeit gibt einen Überblick über die Entwicklung und Verwendung gewisser Kunststoffe während der letzten 40 Jahre. Die vom Verfasser vor 20 Jahren begonnene Forschungsarbeit hat in gewissem Masse zum Fortschritt der Untersuchungen, der Entwicklung und der Anwendung verschiedener Kunststoffe beigetragen. Die Zahl der erhältlichen Kunststoffe ist in den Augen des Chemikers fast unbegrenzt. Die Möglichkeiten der Verwendung von Kunststoffen in der orthopädischen Chirurgie sind unendlich, und ihre Anwendung in der allgemeinen Chirurgie scheint zu den wirklichen Fortschritten in der zukünftigen Medizin zu gehören.

RÉSUMÉ

Ce travail est une revue du dévéloppement et de l'usage de certains materiaux plastiques pendant les derniers quarante ans. L'auteur qui a commencé ces recherches avant quarante ans, aide à un certain degré à avancer l'étude, le dévéloppement et l'usage de différents matériaux plastiques. Le nombre des plastiques à disposition du chimiste est presque sans limit. Les possibilités de l'usage des plastiques dan la chirurgie orthopédique est presque sans limit et le futur de l'usage des plastiques en chirurgie générale parait être un vrai dévéloppement futur en médecine.

SUMÁRIO

Este artigo constitui uma revisão do desenvolvimento e uso de certos materiais plasticos nos ultimos quarenta anos. Este trabalho de pesquiza, iniciado pelo autor há vinte anos, auxiliou de alguma forma o progresso do estudo, desenvolvimento e uso de varios plasticos. O numero de plasticos disponiveis ao quimico é praticamente ilimitado, as possibilidades dos plasticos para uso na cirurgia ortopedica são tambem ilimitadas e o futurodo uso dos plasticos na cirurgia geral parece ser um futuros acontecimentos reais da medicina.

RIASSUNTO

Vengono esposti ed elencati i materiali plastici usati in chirurgia negi ultimi 40 anni. Il lavoro di ricerca è stato iniziato 20 anni or sono ed ha giovato allo studio, allo sviluppo e al progresso di tali sostanze. Il numero di esse è praticamente illimitato, come pure illimitate sono le possibilità di impiego in chirurgia ortopedica, mentre in chirurgia generale l'uso dello sostanze plastiche diventerà, nel futuro, una fonte di indiscutibile progresso.

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Principles of Plastic Surgery in Industry

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INDUSTRIAL injuries undoubtedly would profit by application of the principles of plastic surgery in the course of their treatment. Those treating injuries from the scalp to the toes can utilize plastic principles to great advantage in securing improved function, less disability and more pleasing cosmetic results than can be obtained otherwise.

Scalp injuries occasionally occur from falling objects or flying pieces of metal in industrial plants. These scalp lesions usually heal with ordinary treatment. Occasionally a portion of the scalp is actually severed, leaving exposed skull, which does not permit a direct skin graft on the bone. Such wounds should be treated immediately by the transfer of a flap from a surrounding area to cover the denuded bone of the skull (Fig. 1). The necessary skin graft can then be applied to the donor site on the galea, and the area covered with a tied-on dressing. This is easily applied by leaving the skin graft sutures long and tying them over a gauze pad of sufficient size to produce the necessary pressure.

The skin-grafted area can then usually be covered by the hairdress, but if it is conspicuous it is sometimes possible, by multiple excisions, to advance the surrounding scalp in successive stages and eliminate the conspicuous area.

The use of hair nets for women working near machines should be mandatory, but frequently none are used, and portions of the scalp, or, in fact, the entire scalp, may be avulsed after entanglement of the hair in the machinery.

When a scalp is avulsed, the hair should be removed and preserved. In my opinion it would be a good principle in all cases to split the scalp down to the base of the hair follicles and use this outer layer (almost a full-thickness graft) immediately as a hair-bearing skin graft.

It has been proved on many occasions that replacement of the avulsed scalp is futile, because the entire scalp becomes necrotic.

Any or all portions of the scalp that still remain uncovered can be allowed to granulate, and split-thickness grafts can be applied later over the entire area. Grafts applied over a convex surface, such as the crown of the head, need practically no pressure if sutured on with some tension. This done, paraffin mesh gauze can be stretched over the scalp and sutured around the lateral margins to hold the grafts down in firm position. Over this, simple moist dressings can be applied, and usually the graft will take without cumbersome pressure dressings applied over the entire head.

The patient's own hair can be sent out for the preparation of a wig. In addition to this, another wig should be purchased, because they require cleaning as often as the normal scalp needs shampooing. Under normal use and care, a wig will have to be replaced approximately every eighteen months.

Injuries to the facial bone are fairly common industrial accidents. One of the most frequent injuries is crushing of the malar bone. Swelling follows rapidly, and malar bone (Fig. 2). Swelling follows

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rapidly, and the diagnosis of this type of depressed fracture should be made at the earliest possible moment and reduction carried out to reduce deformities to a minimum. I usually elevate such malar depressions with the region under pentothal or thorough infiltrative anesthesia around all the smaller bone attachments. By passing an elevator beneath the malar bone, through a ¼ inch (0.6 cm.) incision above the second molar tooth, and lifting upward, most malar bones can be elevated into good position. Pressure from the outside toward the nasal bones will impact the fracture at the infraorbital foramens and maintain the bone in position without further complications. If there is much comminution, it is a good principle to make an incision at the outer angle of the orbit. A drill hole is then made in the corner of the frontal bone and the malar bone, through which the malar bone is wired up into position as soon as possible after the accident.

Fig. 1.—Wound caused by flying metal, which severed portion of the scalp and lacerated the ear. Exposed bone demanded immediate coverage with scalp flap from occiput. A split thickness graft was applied on the gala at the donor site and tied on with sutures left long at the wound edges. The edge of the ear was replaced and sutured.

Fig. 2.—Malar bone fracture. This should be diagnosed early and elevation attempted at once. Pentothal or local anesthetic is used, and a curved elevator is introduced intraorally through a small incision over the second molar tooth. The bone should be lifted upward and forced inward by thumb pressure over the malar bone to cause impaction in the infraorbital region.

Transverse fractures of the maxilla are encountered in some cases. If the infraorbital rim is intact, good suspension can be secured by passing a stainless steel wire through a small drill hole in the infraorbital rim down under the lip and attaching it to wires fastened around the upper teeth or an arch bar. The jaw can then be suspended in the proper position, and external appliances can be avoided (Adams method).

Severe comminuted fractures involving the entire face may require external appliances of various forms to maintain the position of the numerous fragments. Frequently open reduction may be required for satisfactory results.

Crushing injuries of the nose sometimes result in decided deformities in spite of all efforts toward elevation.

The amount of the depression in such a case can be determined by measuring the distance from the dorsal skin of the nose to the base of the metal of a profilometer. The length of the necessary transplant can also be determined in this way, and a proper piece of preserved cartilage or ilium can be fashioned to fill the defect. The transplant is inserted through a midcolumellar incision into a tunnel formed beneath the nasal skin.

The nose or some other portion of the face occasionally may be severed by an exploding emery wheel or other industrial

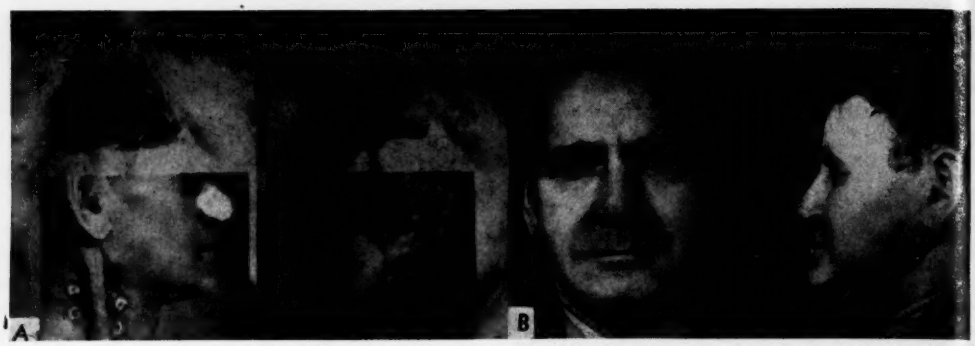

Fig. 3.—*A*, tip of the nose severed by an exploding emery wheel, repaired with a tube pedicle picking up hairless matching skin from behind the ear. *B*, photographs taken nine years later, showing well matching graft and inconspicuous neck scar.

missile. The nasal tip may be restored by one of several methods. In treating men I try to avoid forehead scars and in most cases use a tube pedicle graft taken from the sternocleidomastoid muscle area. Skin from behind the ear is used for the reconstruction of the nasal tip. This produces a nasal tip with excellent matching and hairless skin and prevents the forehead scar (Fig. 3). In women a forehead pedicle can be used satisfactorily. The resultant skin-grafted area on the forehead may be covered by the coiffure.

Burns from industrial explosions frequently involve the eyes and eyelids. In cases of severe ectropion the cornea is greatly endangered by constant exposure (Fig. 4). An early effort should be made to correct the ectropion by skin grafts applied to the lids. If the area is small, an excellent graft can be obtained from the upper eyelid, larger masses of skin of good matching quality can be obtained from the postauricular region.

When the eye and the eyesocket have been destroyed by acid or other agents, a new eyesocket should be constructed. The skin of the upper and lower lids is undermined to the orbital rims. A skin graft is sutured to the edge of the denuded underside of the upper lid and packed into the eyesocket, then back around to the edge of the denuded lower lid. Pressure can be maintained on this graft by inserting a simple petrolatum gauze packing or a mold of modeling compound. This pack is left in place from six to eight days, after which a prosthetic appliance should be employed to maintain the size of the orbit and avoid shrinkage of the skin graft. Later an artificial eye can be made to correspond with the normal eye.

In some cases the eyelashes may also be destroyed. These are replaced by making a horizontal incision in the edge of the lid and inserting a thin line of hair-bearing skin. Its position is maintained by through-and-through mattress sutures.

Fig. 4.—*A*, severe cheek and lid burns causing ectropion. These should be skin grafted early, to avoid corneal ulceration. *B*, photograph taken twelve years after the operation.

Fig. 5.—*A* and *B*, magnesium burns incurred in industrial plant. The burned areas included the entire face, as well as the ears, the neck and the thighs. *C*, sheet of skin graft applied to forehead, eyelids and nose and another over side of neck and under chin. Both were applied at the first operation. *D*, tube pedicles brought up for reconstruction of ears. Additional grafts were placed over both lips and cheeks, and eyebrow grafts were applied on each side. *E*, result two years later.

The addition of the eyelashes adds much to the restoration of normal facial expression.

Eyebrows are frequently destroyed and can be replaced fairly satisfactorily by the insertion of narrow hair-bearing grafts from the mastoid region or the back of the neck.

Other burned areas should be denuded of necrotic skin as soon as possible and grafting begun at once. Split-thickness grafts over the bony areas of the face (Fig. 5*A*) usually will "take" more readily than will those over the movable parts of the face. Furthermore, grafts over bony areas such as the forehead (Fig. 5, *C* and *D*) remain smooth, while those placed over muscular areas, such as the front of the neck, often take on a washboard aspect and contract to less than half their original size, in spite of all efforts to prevent it.

Fig. 6.—Pigmented facial areas often caused by mine, chemical or other explosions, as well as by street accidents. These can usually be removed by one or more sanding operations.

In coal mine and industrial explosions, pigment is frequently blown into the facial skin. An immediate attempt to remove this pigment, with anesthesia, if necessary, should be made by scrubbing the area with a stiff brush (Fig. 6).

Occasionally particles of pigments still remain embedded in the skin. Later these areas can be thoroughly sandpapered with a rapid revolving sandpaper cylinder, removing practically all the pigmented areas from the face (Fig. 7).

In cases of chemical or explosive burns, the ears are sometimes partially or completely destroyed. They can be partially reconstructed with pedicle flaps brought up from the neck or arms. In some instances, entirely new ears must be constructed (Fig. 5*C*). Any portion of a severed ear that can be recovered should be sent to the hospital with the patient, because the cartilage matrix in this part is by far the best supporting structure upon which to construct the new ear. The skin is removed from this cartilage; then, through the open wound at the site of the injury, a space behind the ear can be undermined and the ear cartilage buried under the skin. The wound is then closed in the usual manner. At a later date, skin

grafts wrapped over a mold of modeling compound are inserted beneath this grafted bit of cartilage, between it and the scalp. Three weeks later the mold is removed, and the auricular appendage is thus separated from the head. A tube pedicle can be brought up from the side of the neck and attached to the curve around the edge of the auricle to form a new helix.

Axillary burns are fairly common and produce restricting bands of skin and scar tissue between the arm and the chest. If there is available tissue under the axilla, down the side of the body, multiple Z plasties can be done; if this is not possible, a large Z plastic flap transferring masses of good skin up into each axilla may be used. This will eliminate the scar tissue bands and produce a more normal range of motion of the extremity.

Occasionally shirt sleeves or other portions of clothing become tangled in machines, avulsing portions of the skin of the upper part of the arm. If such skin masses are not too badly macerated, they can be defatted and used as free grafts, but it is probably better to discard them and immediately replace this denuded skin with split-thickness grafts held on by proper pressure dressings.

The hands, of course, are probably more frequently injured in industrial life than any other portion of the body. Roller injuries and burns cause avulsions or loss of skin from one or both sides of the hand (Fig. 8). These injuries can be covered by thick split grafts (Fig. 9) provided the tendons are not exposed.

The primary repair of severed tendons and nerves is indicated if there is sufficient overlying soft tissue to cover the defect. If, however, the tendon is involved, abdominal pedicles should be prepared to cover this defect. Tendon grafts can be inserted at a later date to restore normal function (Fig. 9*B*). One disadvantage of abdominal pedicles, however, is the fact

Fig. 7.—Instruments used to remove pigment, acne, pockmarks, etc. *Left*, rapidly revolving ½-inch (1.27 cm.) cylinder; *right*, 2 inch by 1 inch (5.08 by 2.5 cm.) cylinder.

Fig. 8.—Roller injury. The palmer skin was avulsed, but, since the tendons could be covered, a thick split skin graft was applied within twenty-four hours.

that they are usually considerably thicker than the normal hand skin and a fatty mass developing in the palm or even over the back of the hand is sometimes objectionable (Fig. 9*C*). This can be reduced in size by repeated excisions from one side and then the other in a defatting process.

If the entire avulsed skin of the hand, together with the underlying fat that usually accompanies such an avulsion, is replaced as a graft, it will almost always result in total failure. It might, however, be worth while to use the avulsed skin, if not too badly damaged, as a covering. The entire skin, when used, should be thinned to a thick split graft thickness and then applied over the denuded area.

Temporary coverage by split thickness skin graft dressings can be used. The

Fig. 9.—Avulsion of skin from both sides of the hand. These areas were covered at once with split skin grafts. *A*, left hand showing avulsion of skin on both sides. Pedicle flaps outlined on patient's right side. *B*, pedicle flap elevated and wrapped around hand. A skin graft was applied to the donor site. *C*, photographs taken twenty years later, showing slight excess of fat in pedicle. The hand has always been functional, however, and no further surgical intervention, such as a procedure to remove the excess fat, was desired.

hands, however, probably should eventually be covered with pedicle grafts, because the thin graft over the exposed bone ends often breaks down, leading to repeated ulcerations and total incapacity of the hand.

Tendon damage, fixation or tendon losses should be repaired, reasonably soon after a proper skin covering has been obtained, by using the palmaris longus or the long extensor tendons of the toes as tendon grafts. It is important that the tendon sheaths be excised to prevent adherence, and the tendon pulleys be conserved or constructed, so that a functional hand can be produced at the earliest possible time. Nerve sutures or nerve grafts should also be attempted at the same time the tendons are repaired.

Injuries to the lower part of the leg, especially over bony areas such as the anterior tibial border, ankle and heel, are frequently the result of heavy falling ob-

Fig. 10.—*A*, facial wound. Heavy needles and sutures should be avoided especially in facial wounds, because conspicuous scars may ruin the patient's social or business prospects. The scar was excised and resutured with subcuticular stitches but the wide ends of the stitch marks are still visible (*B*). This could have been avoided by the use of finer materials and subcuticular stitches at the original operation.

jects, old fractures etc. Although it is time consuming, it is probable that cross leg pedicles, which can be used to cover such areas with a thick mass of normal skin and fat pad, will be better in the long run than many attempts at split grafts, which frequently break down and cause subsequent disabilities.

Ankle defects can be covered by cross leg pedicles from above the knee or the calf of the leg. Heel injuries can be covered with pedicles from these same areas. In older individuals, one must consider carefully the arterial supply and use the means that will be least likely to cause a possible thrombosis, or embolism. Positioning is also important to preserve joint function. In most younger workers, cross leg pedicles should be the method of choice.

To minimize subsequent stitch marking and conspicuous scarring, it is our feeling that in plastic procedures, especially about the face (Fig. 10*A*), the use of heavy needles and suture material, skin clips, etc., should be avoided. Fine needles and fine suture materials should be used and every effort made to leave as inconspicuous a scar as possible. Subcuticular sutures, in our experience, best assure this purpose (Fig. 10*B*).

In the more serious injuries described above, of course, it is essential that normal function be restored at the earliest possible moment to minimize the disability incurred. It is my impression that the principles of plastic surgery applied to these injuries, will accomplish both an improved function, lessened disability and a more pleasing cosmetic result.

ZUSAMMENFASSUNG

Der Verfasser empfiehlt eine umfangreichere Anwendung plastischer Verfahren in der Behandlung von Gewerbeverletzungen einschliesslich der Zerreissungen der Kopfhaut, der Gesichtsknochenverletzungen, der Querbrüche des Oberkiefers, schwerer Splitterbrüche des gesamten Gesichts, Quetschverletzungen der Nase, schwerer Verbrennungen, Ablagerungen von Bergwerkspigmenten in der Gesichtshaut, Sehnen- und Nervenzerreissungen der Hand und Verletzungen der Unterschenkel und der Fussgelenke. Er weist darauf hin, dass die Grundsätze, auf denen die plastische Chirurgie aufgebaut ist, sich in hohem Masse auf dem Gebiete der gewerblichen Schädigungen anwenden lassen und zu einer Verbesserung der Funktion, zur Herabsetzung der Arbeitsunfähigkeit und zu befriedigenderen kosmetischen Resultaten als andere Behandlungsmethoden führen können.

RIASSUNTO

L'autore raccomanda un più largo impiego di metodi plastici nella cura dei traumi professionali, como lo scuoiamento, le fratture delle ossa facciali, le fratture della mandibola, le fratture comminute gravi della faccia, le lesioni da schiacciamento del naso, le ustioni, gravi, i tatuaggi della cute del volto da pigmenti minerari, la sezione di tendini o nervi della mano, le lesioni delle gambe e dell'anca. Viene sottolineato il fatto che i postulati della chirurgia plastica trovano la loro applicazione più completa nel campo industriale e raggiungono un miglioramento funzionale, una diminuzione dei deficit, un perfezionamento dei risultati estetici.

RÉSUMÉ

L'auteur préconise une application plus fréquente des techniques de la chirurgie plastique pour le traitement des lésions industrielles telle que l'avulsion du cuir chevelu de la tête, le traumatisme de l'os facial, les fractures transverses de l'os maxillaire, les fractures comminutives sévères des os du visage, les lésions écrasantes du nez, brûlures sévères, implantation de fragments de substances pigmentaires dans la peau du visage, les tendon

ou nerfs coupés de la main, ainsi que les blessures de la jambe et de la région tibio-tarsienne.

Il montre que les principes, sur lesquels la chirurgie plastique ets basée, peuvent être appliqués à la chirurgie industrielle et qu'ils peuvent améliorer la fonction, diminuer, l'incapacité et obtenir de meilleurs résultats cosmetiques qu'avec des methodes ordinaires.

SUMÁRIO

O autor recomenda o uso mais liberal de metodos plasticos no tratamento das lesões de origem industrial, incluindo avulsão do couro cabeludo, trauma dososos faciais, fraturas transversais dos maxilares, fraturas cominutivas graves de toda a face, lesão por esmagamento do nariz, queimaduras graves, depositos de pigmentos na pele da face, secção de tendões ou nervos na mão, e lesões das pernas e tornozelos. É salientado que os principios em que se baseia a cirurgia plastica são aplicaveis no campo industiral, podendo promovera melhoria da funÉão, diminuir a incapacidade e obter melhores resultados cometicos do que de outra maneira.

Brief and powerless is Man's life; on him and all his race the slow, sure doom falls pitiless and dark. Blind to good and evil, reckless of destruction, omnipotent matter rolls on its relentless way; for Man, condemned today to lose his dearest, tomorrow himself to pass through the gate of darkness, it remains only to cherish, ere yet the blow falls, the lofty thoughts that ennoble his little day; disdaining the coward terrors of the slave of Fate, to worship at the shrine that his own hands have built; undismayed by the empire of chance, to preserve a mind free from the wanton tyranny that rules his outward life; proudly defiant of the irresistible forces that tolerate, for a moment, his knowledge and his condemnation, to sustain alone, a weary but unyielding Atlas, the world that his own ideals have fashioned despite the trampling march of unconscious power.

—*Russell*

Coloscopy: Endoscopic Examination of the Colon

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IN the medical literature of the past few years, a number of authors writing on the problems associated with the diagnosis and treatment of diseases of the colon have referred to the use of a sterile sigmoidoscope introduced through a colotomy incision for endoscopic examination of the colon. This procedure is properly termed coloscopic examination, although this term is not well known. The term is likewise applicable to endoscopic examination of the colonic mucosa by the introduction of a sigmoidoscope through colonic stomas, as in colostomy, transversostomy and cecostomy. It is the purpose of this presentation to discuss and stress the importance of this valuable surgical procedure.

With the use of proctosigmoidoscopic study of the distal 10 inches (25 cm.) of the colon, diagnosis of disease of this segment of the bowel has been exact. Until coloscopic procedures came into use, diseases of the colon proximal to this segment have been diagnosed only by roentgen studies and surgical exploration of the abdomen. All surgeons are aware of the limitations of both of the latter procedures. Under the best conditions, roentgen studies of the large bowel are unreliable in the diagnosis of small polyps. They are far from adequate in the diagnosis of any lesion less than 1 cm. in diameter, particularly if the lesion is sessile. In our experience, coloscopic study has revealed the presence of lesions impossible to discover by repeated roentgen studies and the most careful and repeated inspection and palpation of the entire bowel during laparotomy.

Bacon, who has been using this procedure since 1944, observed a rate of error of 9 per cent in roentgen studies when a coloscopic procedure was used.[1] Certainly this percentage will vary with roentgen technics and interpretations. It is unfortunate that some roentgen studies are limited to the use of the so-called opaque barium enema, and others to the use of only a double contrast study. Either study, if relied on exclusively, will fail to disclose polyps and other lesions. In our opinion,

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an opaque barium enema study should be done first and followed with a double contrast study. We have been impressed with the double contrast technic with "baridol," described by Jones and his co-workers of Stanford Medical School,[2] and more recently the use of "barotrast" as developed by Foster. With newer and better roentgen technics to be anticipated, the percentage of missed diagnoses of lesions of the colon will be decreased. Nevertheless, until the time when roentgen diagnosis of all lesions of the colon is 100 per cent accurate, coloscopic study will remain a valuable adjunct in the diagnostic armamentarium.

Deddish and Fairweather have reported their observations in 99 patients examined coloscopically. Of 76 patients subjected to laparotomy because of roentgen evidence of polyps, 50 per cent had additional mucosal lesions. Of 23 patients in whose cases a diagnosis of carcinoma of the colon had been established, 65 per cent had associated benign polyps not seen by roentgen ray.[3] It is our opinion that coloscopic study is indicated far more often than its occasional use at present would imply.

Indications. — Polyps and Malignant Change: When a polyp of the lower 10 inches (25 cm.) of the bowel is diagnosed by proctosigmoidoscopic means there is a mandatory indication for roentgen studies of the large bowel to rule out the presence of additional lesions above the reach of the scope. In our opinion, when transabdominal colotomy or resection is indicated for removal of a polyp, coloscopic study is mandatory to rule out multiple lesions. It has been the practice of some surgeons[4] to insert the examining finger through the colotomy incision, after finding a polyp in that segment of the bowel, and palpate the proximal and distal loops for a distance up to 8 inches (20 cm.). This is a far better practice than is examination of the external surface of the bowel. Even this procedure, however, will fail to reveal some small lesions that can be discovered coloscopically, especially in obese patients or in those cases in which previous surgical procedures or infectious

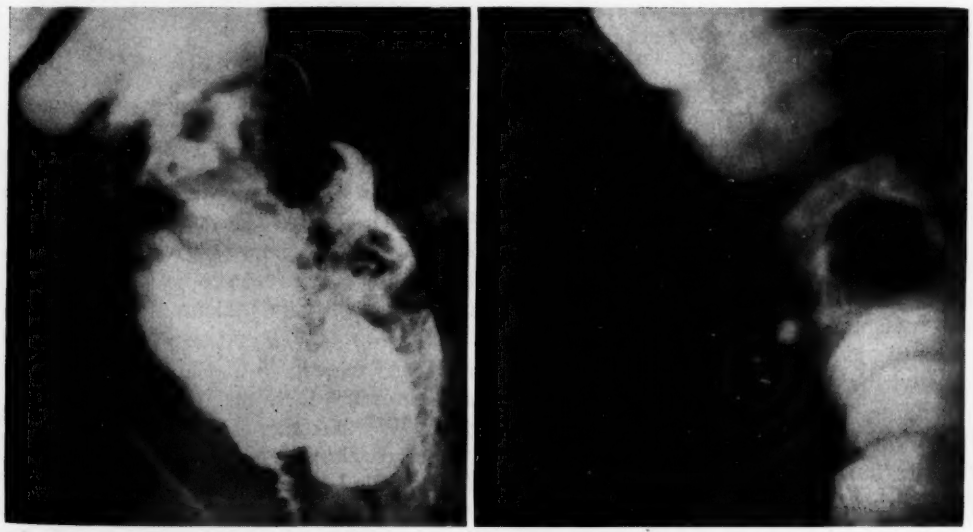

Fig. 1.—Roentgen evidence of carcinoma of cecum and lesion of left half of colon associated with diverticulosis. Lesion of left colon not palpable at operation.

processes have caused scarring or adhesions (Figs. 1 and 2).

We agree with Miller,[5] who has stated that, since it is impossible to predict which polyps will become malignant, all polyps must be regarded as premalignant lesions and removed or destroyed at an early date. The size of a polyp has nothing to do with its potential malignancy. Tiny sessile hyperplastic excrescences, referred to as "raindrop" polyps because of their appearance, are probably forerunners of larger lesions. Even these small lesions have been observed upon occasion to contain adenocarcinoma.[6] This type of polyp can be diagnosed only by visualizing it on the mucosal surface. Through the scope these tiny lesions, often multiple, can be treated appropriately, usually by simple destruction with the cautery.

Statistics have indicated that 80 to 85 per cent of polyps of the colon occur on the left side, between the splenic flexure and the anorectal line. When there is an indication for colotomy in this segment, coloscopic visualization of this segment is likewise indicated. When there is evidence of a polyp in the right or transverse portion of the colon, coloscopic study of the entire colon is indicated.

What we have said with regard to polyps holds true for carcinoma of the colon. It has been our practice to have barium enema and air contrast studies done preoperatively on all patients with malignant disease of the anorectum and colon. In spite of this precaution to rule out multiple lesions, it was our misfortune and embarrassment a year ago to have a patient present herself at the postoperative clinic with a small pedunculated adenoma protruding from the abdominal colostomy. Had coloscopic study been done at the time of operation, this polyp would have been removed.

In a patient who has a carcinoma with impending obstruction, when preoperative barium studies are not deemed advisable because of the possibility of completing the obstruction, coloscopic study of the colon is positively indicated.

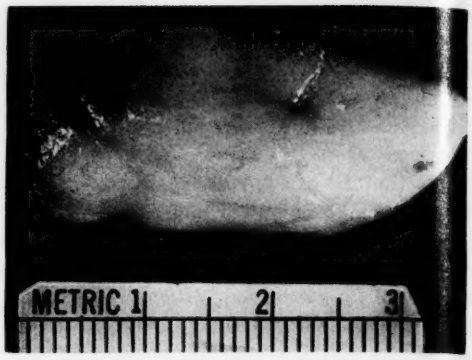

Fig. 2.—Submucosal pedunculated lipoma of left half of colon diagnosed coloscopically and excised through colotomy.

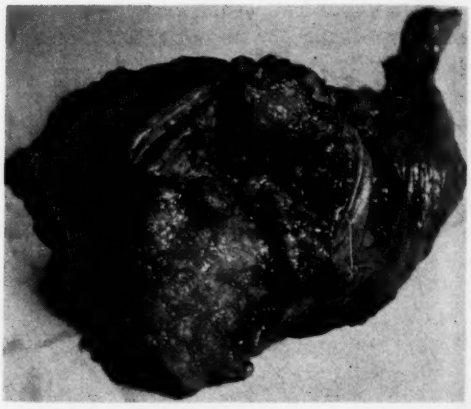

Fig. 3.—Large carcinoma occurring in proximal limb of transversostomy, diagnosed coloscopically and resected.

Bleeding of Undetermined Origin: Most surgeons who have had active residencies and practices have met patients who complain of bleeding from the rectum, in whose cases repeated preoperative studies have failed to disclose the source and cause. When all studies have so failed, laparotomy is undertaken. Even with the most careful and repeated inspection and

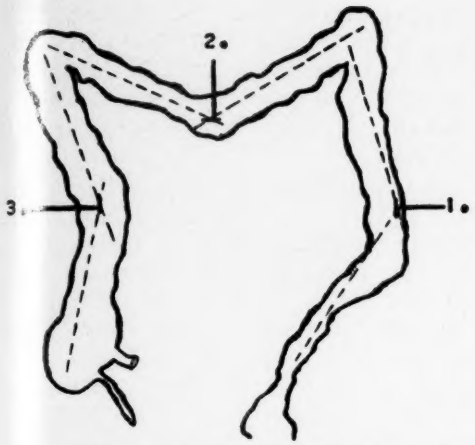

FIG. 4.—Usual three colotomy incisions for coloscopic visualization of the entire colon.

palpation of the entire abdominal gastrointestinal tract, there is an occasional patient in whom the cause of bleeding is not found. Here, then, is the patient deserving of coloscopic investigation. In these circumstances we do not consider it justifiable to close the abdomen unless complete coloscopic study has been done.

Diverticulosis and Diverticulitis: Not infrequently we encounter a patient who has bleeding from the rectum, but no other symptoms, and roentgen evidence of multiple diverticula of the entire colon without evidence of diverticulitis. Although some of these patients are treated expectantly and conservatively with blood transfusions, coagulants, iron and liver extract, etc., a number of them, after repeated and often severe hemorrhages, come to operation for exploration. Not uncommonly, in these cases, the source of bleeding is still undetermined after laparotomy, and resection of the sigmoid is done empirically. We have no argument with the theory that the source of bleeding is in the sigmoid in a substantial number of these cases. We are convinced, however, that coloscopic study at the time of laparotomy will often be helpful in locating the bleeding segment. If it should fail, we can at least say for certain that there are no other lesions responsible for the bleeding.

The presence of diverticula, diverticulitis, or the residual changes due to this disease, often renders the roentgen demonstration of small adenomas or invasive lesions difficult or even impossible. In the presence of diverticular disease the continued or intermittent presence of small amounts of blood as noted in the stool or seen on the bowel wall during sigmoidoscopic examination is of extreme significance. This type of bleeding seldom occurs from diverticula. Frequently it indicates the existence of a polypoid or invasive lesion.[7]

Colostomy Stomas: Many surgeons have followed their patients with colostomies for years. The usual check-up examination of these patients consists of careful palpation of the abdomen and the scars, and insertion of the examining finger into the stoma. Several cases in our more recent experience have taught us the value of including coloscopic study routinely in the examination. One patient was operated on eleven years ago; a diversion transversostomy was performed because of the presence of a sigmoidovesical fistula due to diverticulitis. Last year this patient, who had refused further surgical intervention for repair of the fistula, began to pass gas and feces into the bladder again. He was operated on, and a mass was palpated between the two limbs of the transversostomy, which was thought to be due to perforation of a diverticulum and thus resulting in canalization between the two limbs. Because of the poor condition of the patient, a temporary cecostomy was done. Although there was some general improvement, the cecostomy did not divert the fecal stream from the bladder, and a coloscopic procedure was performed in the proximal limb on one of his postopera-

tive visits. A large carcinoma was observed; this had caused the channeling. Since resection of the entire transverse and descending colon, the patient has had no further complaints (Fig. 3).

Another patient recently operated on, 81 years old, had been followed for nineteen years after combined abdominoperineal resection for adenocarcinoma of the rectum and squamous cell carcinoma of the anal canal. Coloscopic study of the colostomy, done as a routine office procedure, disclosed an adenoma on a long pedicle 6 inches (15 cm.) proximal to the stoma. Roentgen studies revealed two other lesions near the splenic flexure.

Segmental Ulcerative Colitis: In the presence of this less common form of dreaded disease, roentgen studies and even examination of the bowel at operation will fail to reveal the exact segmental limitation of the lesion. Before we decide on the amount of colon to be resected, we consider it wise to obtain endoscopic visualization of the supposedly uninvolved mucosa adjacent to the disease process. Theoretically it is possible to postulate that there might be a lessened rate of recurrence if this procedure were performed and no visible involvement of the adjacent mucosa allowed to remain.

Contraindications. — With experience and teamwork, the coloscopic technic does not appreciably lengthen an operation on the bowel, whether it is a simple colotomy and excision of a polyp, resection and anastomosis, or resection and colostomy. The one definite contraindication to this procedure is the patient's inability, because of poor condition, to withstand the additional procedure. Impending shock, poor anesthesia, severe blood loss and cardiac or respiratory complications are all valid reasons for hastening the completion of the operation without the addition of coloscopic study.

Of course, this procedure is not indicated if the bowel is not properly prepared; and there seems to be no justification for its use where there is diffuse disease of the entire bowel, as in cases of diffuse chronic ulcerative colitis or familial polyposis.

Preparation of the Colon. — Successful coloscopic study depends largely upon proper preparation of the colon. Not only must the bowel be emptied of feces, but an attempt should be made to sterilize the bowel of pathogens, as one does when resection is contemplated. Ideally these patients should have absolutely nonresidual liquid diets for two days prior to operation. Two ounces of castor oil, or three doses of 1 ounce of 50 per cent magnesium sulfate, should be administered two days before the operation in order to clean out whatever residue is present.

To reduce the number of bacterial pathogens, a course of antibiotics is indicated. We favor oral streptomycin or terramycin for forty-eight hours before the operation. It has been our experience that a five-day preparation with sulfaphthaladine leaves a gummy residue in the bowel. A five-day preparation with sulfasuxidine

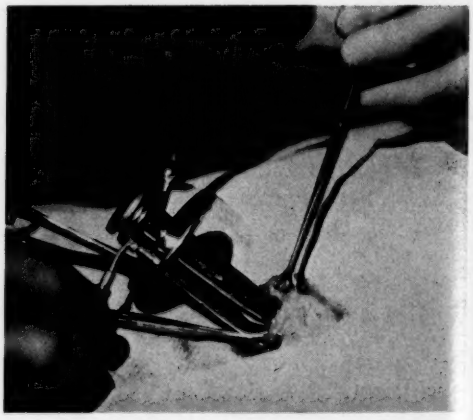

Fig. 5.—Introduction of scope, undertaken only after carefully packing off the peritoneum and abdominal wound, making the colotomy incision and grasping the edges of the wound with Babcock forceps.

or a two-day preparation with neomycin leaves a large amount of thickened liquid in the bowel.

On the day before the operation our patients are given small doses of paregoric and, that night, cleansing tap water enemas. A rectal tube with the Wangensteen type of suction placed in the rectum for two or three hours before the operation is also helpful in emptying the rectum and colon of residual fluid.

Technic. — Relaxation of the abdomen by good anesthesia is of major importance. With the scope inserted through an incision in the bowel, the abdomen must be free of pushing; good exposure is a necessity. We favor the use of spinal anesthesia. When this is contraindicated, inhalation mixtures and intravenous pentothal, supplemented with muscle relaxants, can be quite adequate.

We have found that the lower left abdominal paramedian incision, extending from 1 inch (2.5 cm.) above the pubic spine to 1 inch (2.5 cm.) above the umbilicus gives excellent exposure. The left rectus muscle is retracted laterally. On occasion, especially in obese patients, the transverse incision in the lower left quadrant, just below the level of the umbilicus, may give better exposure. With this incision, the left rectus muscle is transected.

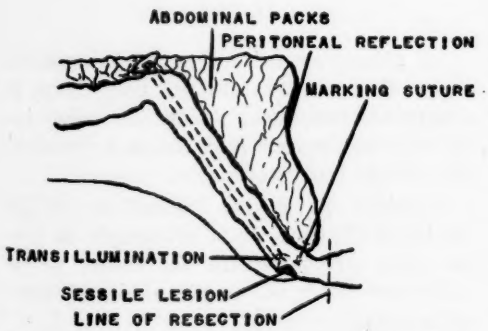

Fig. 6.—Distal lighted sigmoidoscope transilluminating bowel at level of lesion, marking suture placed.

If necessary, the right rectus can be transected in a like manner after the skin incision has been extended to the right.

Before incisions are made in the bowel, the area of incision must be packed off from the rest of the peritoneal cavity and the abdominal incision in case of spillage and contamination. This is accomplished with double thicknesses of abdominal packs. As with proctosigmoidoscopic procedures, a long suction tip and other sigmoidoscopic instruments, including long cotton swabs, biopsy forceps and cautery, must be readily available and in working order.

For coloscopic study of the entire colon, three colonic incisions are necessary. These incisions are made in the ascending colon, midway between the cecum and the hepatic flexure; in the midtransverse colon, and at the juncture of the descending and sigmoid colon. In the occasional case in which the right half of the colon is short, the incision is placed in the cecum (Fig. 4). In these sites the bowel wall is incised in the anterior taenia. The incision is just long enough to admit the scope, usually about 1 inch (2.5 cm.). As soon as the mucosa has been incised, the edges of the wound are grasped with Babcock visceral forceps and elevated (Fig. 5) while suction is applied to the lumen contents. The sigmoidoscope is introduced and passed its full length distally and proximally, with direct visualization of the entire mucosal surface. With unusually long or redundant segments of bowel, the scope can be passed with one hand and the other hand used to arrange the additional bowel in accordion fashion around the scope. Care must be taken that there is no contamination from the face or mask of the examiner, and the scope, upon removal, should be suitably sterilized before it is used on another segment of the bowel. As each segment is examined, the colotomy is closed by the two-layer technic, the

mucosa being inverted just as in any closure of bowel.

We prefer to use a sigmoidoscope with a distal light source. If a lesion is visualized, even though not palpable, the transillumination of the distal light will serve as a guide either for making an incision in that area for the simple excision of a polyp, or for the placing of a marking suture if the segment is to be resected. We have found the latter maneuver invaluable in establishing the distal line of resection of small sessile carcinomas at, or just above, the pelvic peritoneal reflection (Fig. 6).

In recent years we have been impressed with a number of reports in the literature concerning local recurrences of carcinoma due to local implants at the suture line of anastomoses. In 1951 Cole, and later Goligher and his associates, reported ample evidence that at least half of recurrences at the suture line were due to local implants of intraluminal desquamated cells.[8] In 1954, McGrew, Laws and Cole reported that viable desquamated malignant cells were present in 42 per cent of proximal ends and in 65 per cent of distal ends of resected specimens at average distances of 10 and 21 cm.[9] In the same year, Cole and Southwick advocated routine ligation of the lumen of the colon several inches above and below the tumor before mobilization of the involved intestine is begun, in order to prevent intraluminal spread of this type.[10] This year Pomerantz and Garlock have introduced the use of a colon cover for the involved segment, secured by sutures placed proximal and distal to the lesion occluding the lumen.[13]

In the presence of carcinoma of the colon, the lumen above and below the lesion should be occluded by ligation. Introduction of the sigmoidoscope into the segment of bowel to be resected is absolutely contraindicated. When suspicious lesions are discovered coloscopically, the resection should include several inches of bowel beyond the site of introduction of the scope.

Complications. — Paralytic ileus is the most common complication of coloscopic study. Although it is not of serious consequence, usually subsiding within forty-eight hours, this complication has been constant in our experience. Other complications that might be expected to occur occasionally with increased use of this procedure are perforation, abscess and peritoneal infection, hemorrhage and wound infection. With care and experience, the incidence of these complications should certainly be reduced to a very low level.

SUMMARY

Coloscopy is a valuable surgical procedure. Its particular value is in the diagnosis of small lesions of the colon unrevealed by roentgen studies and laparotomy and in determining the presence or absence of multiple pathologic processes.

The authors describe the indications and contraindications for the procedure, the preparation of the colon, the technic and the complications. More frequent use of coloscopic procedures will contribute to our more successful diagnosis and treatment of diseases of the colon.

RÉSUMÉ

La côloscopie est un moyen diagnostic utile. Elle est très efficace pour faire le diagnostic despetites lésions du côlon invisibles aux rayons-X et même à l'examen pendant la laparotomie.

L'auteur parle des indications et des contre-indications de la côloscopie, la préparation préoperatoire du côlon, de la technique de la côloscopie et de ses complications.

Il préconise l'application de ce moyen d'examen dans un plus grand nombre de

cas pour assurer un diagnostic correct et un traitement efficace.

SUMÁRIO

A coloscopia consitutui um metodo cirurgico de valor, particularmente no diagnostico de pequenas lesões do colo, não reveladas por estudos radiologicos e laparotomia e para a determinação da presença ou ausencia de processos patologicos multipios.

O Autor descreve as indicações e contra-indicações do processo, o preparo do colo, a tecnica eas complicações. O uso mais frequente da coloscopia contribuirá para o diagnostico com maior sucesso e para o tratamento das molestias do colo.

RIASSUNTO

La colonscopia è un metodo utile nella diagnosi delle lesioni circoscritte del colon che sfuggono all'indagine radiologica, e sopratutto per determinare la presenza o l'assenza di lesioni multiple.

L'autore elenca le indicazioni e le controindicazioni del metodo, il modo di preparare il colon, la tecnica e le complicazioni. Un uso più generalizzato della colonscopia porterà certamente un miglioramento nella diagnosi e nella terapia delle malattie del colon.

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Upon the very books in which philosophers bid us scorn ambition, they inscribe their names. They seek publicity for themselves on the very page where they pour contempt upon publicity.

—*Cicero*

Limitations of the Injection Treatment of Hemorrhoids

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IN order to discuss the limitations of the injection treatment of hemorrhoids one must make a correct diagnosis, properly select one's cases, know the limitations of the solution to be injected, recognize the contraindications and the complications that may occur and consider the results one plans to accomplish.

A proctosigmoidoscopic study should be made before instituting any treatment for hemorrhoids, to assure oneself that there is no active or latent disease of the anorectum or lower portion of the sigmoid.[1] Only when more serious causes of bleeding have been ruled out should injection therapy be performed.

The injection treatment is a legitimate procedure, recognized and generally accepted by the profession. It has been adopted and frequently used by nearly all proctologists, depending upon the type of hemorrhoid encountered. It is not the treatment of choice in all cases; neither should it be condemned in favor of other surgical procedures. Its value should be estimated in connection with every hemorrhoidal problem.[2]

External hemorrhoids should never be treated by injection; hence, injection should be limited to certain other types of hemorrhoids.

An analysis of the records of the 500 patients who came recently to my office is presented in Table 1. Of the 500 new patients represented in Table 1, 226, or 45.2 per cent, were without internal hemorrhoids, and 274, or 54.8 per cent, had internal hemorrhoids. This is about the average proportion as reported by other proctologists.

Table 2 contains data on 274 patients with internal hemorrhoids. In 37, or 13.5 per cent, these were present without other anorectal pathologic conditions. Of these, 19, or 6.9 per cent, had nonprolapsing internal hemorrhoids. Thirteen, or 4.8 per cent, had internal hemorrhoids that prolapsed and reduced themselves. Five, or 1.8 per cent, had internal hemorrhoids that prolapsed and had to be reduced digitally.

The patients with internal hemorrhoids and other anorectal disease numbered 237, or 86.5 per cent. Of these, 102, or 37.2 per

TABLE 1.—*Data on 500 New Patients*

With Internal Hemorrhoids	Without Internal Hemorrhoids
274 (54.8%)	226 (45.2%)

TABLE 2.—*Data on 274 Patients with Internal Hemorrhoids*

	Without Other Anorectal Lesions	*With Other Anorectal Lesions*
Nonprolapsing internal hemorrhoids	19 (6.9%)	102 (37.2%)
Internal hemorrhoids that became prolapsed and reduced themselves	13 (4.8%)	67 (24.5%)
Internal hemorrhoids that became prolapsed and had to be reduced digitally	5 (1.8%)	68 (24.8%)

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cent, had non-prolapsing internal hemorrhoids, and 67, or 24.5 per cent, had internal hemorrhoids that prolapsed and reduced themselves. In 68, or 24.8 per cent, the internal hemorrhoids were prolapsed and had to be reduced digitally.

If the selection is limited to cases of nonprolapsing internal hemorrhoids without other anorectal disease, I can select only 6.9 per cent.

I realize that these limits could be extended if I included the cases of nonprolapsing internal hemorrhoids associated with other anorectal disease, by removing or treating the associated lesions and subsequently treating the internal hemorrhoids by injection.

Again, it is known that a certain percentage of patients affected with internal hemorrhoids which become prolapsed and reduce voluntarily, and are unassociated with other anorectal pathologic lesions, will usually respond to injection. In this way the limitations of selection could be extended, depending on the surgeon's enthusiasm for the injection treatment.

The associated anorectal lesions complicating the internal hemorrhoids encountered in this series of cases were: external skin tags; external thrombotic hemorrhoids; anal cryptitis; hypertrophied anal papillae; anal fissure; ischio-anal abscess; pelvorectal abscess; rectal polypi; prolapsed rectal mucosa; anorectal fistulas; ulcerated, fibrotic, strangulated and gangrenous hemorrhoids; radiation proctitis; ulcerative proctosigmoiditis; pruritus ani; epithelioma, and carcinoma of the rectum.

The hemorrhoidal lesions are usually well advanced before one sees the patient, because patients tend to delay diagnosis and treatment. Naturally the condition becomes complicated by other anorectal disturbances.

It is unwise to make use of the injection treatment without removing the associated anorectal lesions, since this relieves only part of the disease.[3]

No attempt is made to destroy the veins by using a strong solution, which would cause sloughing. A weaker or sclerosing solution is injected into the submucosa and into the tissues surrounding the radicles of blood vessels; this produces an inflammatory reaction, causing obliteration of the radicles of the hemorrhoidal veins by thrombosis to control bleeding, followed by fibrosis to fix and draw up the redundant mucosa.[4]

Many solutions can be used for the injection treatment of hemorrhoids, but the preferred way is to introduce a solution that is nontoxic and sufficiently irritating to cause adhesions, but not so strong as to produce a slough.[5]

Only by experience can one determine the amount of solution that should be injected and the frequency of injections.[6] Any hemorrhoid showing signs of induration from a previous injection should not be again injected until the induration has subsided and the mass has softened. The interval between injections should, therefore, not be governed by time.

At present most physicians are using mild sclerosing agents such as 5% quinine urea hydrochloride, 5% phenol in vegetable oil, or quinuride solution.

However, some physicians must have their own "special formula," in view of the fact that they claim to be getting better results.

I have found no advantage in using more than one sclerosing solution in the treatment of large nonprolapsing internal hemorrhoids.

Five per cent quinine urea hydrochloride or quinuride should not be injected into a patient who has an idiosyncracy to quinine. Likewise, it should be prohibited in pregnancy. During pregnancy I use 5 per cent phenol in oil to avoid the harmful effects of quinine.

F. B. Campbell[7] has stressed the fact

that a spastic sphincter and tenderness probably indicate infection and proposes a rule: When in doubt, do not inject.

For external-internal hemorrhoids operation is advised. Some physicians, however, inject the internal portion to control bleeding and reduce the size of the hemorrhoid. The solution may infiltrate areas distal to the pectinate line and involve the external sphincter muscle, causing a slough that may destroy a portion of the external sphincter muscle and interfere with continence.

In the presence of senility or disease causing general debility, such as diabetes, cardiorenal disease, tuberculosis, asthma or severe anemia, the patient is a poor surgical risk. Sclerotherapy is of value even though the benefits derived therefrom are temporary.

Patients with bleeding internal hemorrhoids who cannot spare the time from business, who will not submit to adequate surgical treatment or who fear an operation, should, by necessity, receive injection therapy. They should be informed, however, of its limitations.[8]

It is necessary to have a thorough knowledge of the complications that may occur during the course of injection treatment. All physicians who have so treated a number of hemorrhoids must admit that they have encountered sloughs. These sloughs are usually superficial and of no serious consequence. At times a hemorrhage may occur, and it is usually secondary to a slough. Severe pain, submucous abscess, marginal abscess and fistula, stricture, pylephlebitis and pyemia have been reported and are usually either the result of poor judgment in the selection of patients or of faulty technic.

Quinine sensitivity has been mentioned.

Prolapse may occur after injection, and the patient is warned to replace the prolapsed hemorrhoid, for, should it be allowed to remain, strangulation or gangrene may result.

It has been my policy to select for injection treatment the internal hemorrhoids which do not become prolapsed and are not associated with other anorectal lesions. In such cases the best results are obtained by the submucous injection of a mild sclerosing solution. The internal hemorrhoids that become prolapsed and reduce themselves are treated by injection only after it has been explained to the patient that these injections may give merely temporary relief and that a recurrence of the hemorrhoids may occur. Further injections can be given on the recurrence of prolapse or bleeding. For patients who are without associated anorectal disease and whose internal hemorrhoids were prolapsed and had to be reduced digitally, I use the injections for temporary control of bleeding until operation can be performed. As to the effects on the prolapse, very little improvement attributable to the injection treatment has been observed.

When minor anorectal pathology is associated with internal hemorrhoids, the surgical removal in one operation of both the hemorrhoids and the associated lesions is advised.

There are frequent recurrences following injection treatments. Some physicians are of the opinion that recurrences are due to insufficient treatments and additional injections are necessary.[9]

J. P. Nesselrod[8] has expressed the opinion that an infective process is present in an anal crypt, anal duct and anal gland. Hence, merely treating internal hemorrhoids by injection, without consideration of this etiologic factor, will result in failure as far as permanent cure is concerned.

In my own experience, most internal hemorrhoids are associated with other anorectal pathologic conditions in which anal cryptitis is a prominent factor. These hemorrhoids are not the type for injection therapy and should be removed surgically.

CONCLUSIONS

External hemorrhoids should never be treated by injection of a sclerosing solution.

The injection treatment of hemorrhoids should be limited to patients with nonprolapsing internal hemorrhoids and without other anorectal pathologic change.

Injection treatment is valuable for patients with internal hemorrhoids who are poor surgical risks, who refuse operation, or who are aged. It must be explained, however, that, although symptomatic relief may be obtained, a permanent cure cannot be promised.

The limits of the injection treatment of hemorrhoids can be extended for nonprolapsing internal hemorrhoids with associated anorectal pathologic change if the associated anorectal condition is treated, or surgically removed, and the hemorrhoids injected.

SCHLUSSFOLGERUNGEN

Äussere Hämorrhoiden sollten niemals mit Einspritzungen sklerosierender Lösungen behandelt werden.

Die Einspritzungsbehandlung von Hämorrhoiden sollte auf Kranke mit nicht prolabierenden inneren Hämorrhoiden und ohne andere Erkrankungen des Afters und Mastdarms beschränkt bleiben.

Die Einspritzungsbehandlung ist von Wert für Kranke mit inneren Hämorrhoiden, wenn die Patienten ein schlechtes chirurgisches Risiko darstellen oder die Operation ablehnen oder zu alt sind. Es muss ihnen aber klar gemacht werden, dass diese Behandlung zwar eine symptomatische Erleichterung verschaffen, aber keine dauernde Heilung garantieren kann.

Die Anwendbarkeit der Einspritzungsbehandlung kann auf nicht prolabierende innere Hämorrhoiden bei gleichzeitigem Bestehen anderer anorektaler Erkrankungen ausgedehnt werden, wenn diese Begleiterkrankungen behandelt oder chirurgisch entfernt werden können und sich die Einspritzungsbehandlung anschliessend ausführen lässt.

RIASSUNTO

Le emorroidi esterne non devono mai essere trattate col metodo sclerosante. Questo metodo deve essere riservato ai malati con emorroidi interne non prociden ti e senza altre lesioni anorettali.

La cura sclerosante è adatta a pazienti con emorroidi interne e in cattive condizioni generali, o avanti negli anni o quando rifiutino l'intervento chirurgico. Bisogna tuttavia che essi sappiano che la guarigione non può essere assicurata, anche se si ottiene un miglioramento dei disturbi.

Quanto alla presenza di lesioni anorettali associate, esse devono sempre essere curate chirurgicamente o, comunque, trattate a parte quando si esegue la terapia sclerosante.

CONCLUSIONES

Les hemorrhoides externes ne doivent jamais être traitées par l'injection d'une solution sclérosante.

Le traitement des hémorrhoides par injection doit être limité à des patients avec des hémorrhoides internes et sans aucune autre lésion pathologique ano-rectale.

Le traitement par injection est valable pour des malades qui sont atteints des hemorrhoides internes et qui sont trop affaiblis pour subir une opération, pour ceux qui refusent l'opération ou qui sont trop agés. Aussi faut il expliquer que, malgré que les symptômes disparaitront, on ne peut pas promettre une cure permanente.

Les limites du traitement des hémorrhoides par injection peuvent être étendues à des hemorrhoides internes sans prolapsus, associées à une condition pathologique ano-rectale, si on prend soin de la

lésion ano-rectale, ou si on l'enlève chirurgicalément et injecte les hemorrhoides.

CONCLUSOES

As hemorroides externas nunca devem ser tratadas pela injeção de uma substancia esclerosante.

O tratamento das hemorroides por injeção deve ser limitado aos pacientes com hemorroides internas não prolapsadas e sem outra alteração patologica ano-retal.

O tratamento por injeção é de valia para pacientes com hemorroides internas e más condições gerais, que recusam o tratamento ou em pacientes idosos. Deve ser contudo explicado que, embora se obtenha alivio sintomatico, não se pode prometer cura permanente.

Os limites do tratamento das hemorroides por injeção pode ser extendido às hemorroides internas não prolapsadas com alteração patologica anoretal associada, desde que esta ultima seja tratada ou cirurgicamente extripada e as hemorroides injetadas.

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No illumination can sweep all mystery out of the world. After the departed darkness the shadows remain, more mysterious because as if more enduring; and one feels a dread of them from which one was free before. What if they were to be victorious at the last? They, or perhaps what lurks in them: fear, deception, desire, disillusion—all silent at first before the song of triumphant love vibrating in the light. Yes. Silent. Even desire itself! All silent. But not for long!

—Conrad

Metastasis to Ureters and Urinary Bladder from Renal Carcinoma

Report of Two Cases

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THE occurrence of a secondary tumor in the bladder arising from a clear cell carcinoma of the kidney is rare and presents unusual problems in diagnosis, treatment and pathogenesis. The purpose of this paper is to report 2 such cases and discuss the incidence and pathogenesis of these unique secondary neoplasms.

REPORT OF CASES

CASE 1.—A 53-year-old white male physician was admitted to the urologic service of Dr. A. E. Goldstein at the Sinai Hospital on Nov. 6, 1924, with the complaint of hematuria of two weeks' duration. He had previously enjoyed perfect health. The hematuria was painless, intermittent and unaccompanied by other urinary symptoms or by fever. A firm, slightly irregular, nonmovable, nontender mass about 12 cm. in diameter was palpated in the left upper quadrant of the abdomen.

Cystoscopic and retrograde pyelographic studies were performed on November 8. The bladder was normal and showed no signs of a tumor. Retrograde pyelograms showed the characteristic defects of a neoplasm in the lower pole of the left kidney. Roentgenograms of the lungs and long bones revealed no abnormality.

On November 19th the left kidney was removed through a lumbar incision. The pathologic diagnosis was hypernephroma (clear cell carcinoma).

At examination on July 1, 1925, the patient was in excellent health. On Oct. 30, 1927, he returned, complaining of hematuria of two months' duration. Cystoscopic study revealed a large irregular tumor (3 cm. in diameter) on the left lateral wall of the bladder. Biopsy of the tumor revealed similar histologic changes as in the left renal neoplasm. The tumor area was extensively fulgurated. The patient's subsequent course was progressively downhill, and he died from the effects of metastatic pulmonary growths on December 2, thirty-seven months after removal of the kidney.

CASE 2 (Reported through the courtesy of Dr. W. W. Scott, Brady Urological Institute, Johns Hopkins Hospital).—A white male physician 58 years old was admitted to the Brady Urological Clinic on Feb. 5, 1951, complaining of painless hematuria of several weeks' duration. He had no other urinary symptoms. Physical examination disclosed a firm, round palpable mass in the left upper quadrant of the abdomen. Cystoscopic and retrograde pyelographic study on February 3 revealed no evidence of lesion within the bladder and the characteristic roentgenographic changes of a neoplasm in the lower pole of the left kidney. Roentgen films of the lungs and long bones were normal. On February 9 the left kidney was removed. Examination disclosed a large clear cell carcinoma involving the lower third of the kidney.

Approximately one year later (Feb. 1, 1952) the patient returned because of painless hema-

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turia. Cystoscopic study revealed a tumor of the bladder, 1 cm. in diameter, situated immediately above the left ureteral orifice. The tumor was removed by transurethral resection and was reported as a clear cell carcinoma similar in histologic structure to the left renal neoplasm. A recurrence of the bladder tumor on June 5, 1952, was treated by transurethral resection. On July 18 the bladder tumor recurred again, and a suprapubic segmental resection of the bladder was performed, with similar histologic observations. Another bladder recurrence was observed on December 10, and open segmental resection of the bladder was performed again. When the patient returned for reexamination, on March 1, cystoscopic study revealed no evidence of a recurrence.

On June 8 he returned, complaining of pain in the lower lumbar area. Roentgenograms of the spine disclosed metastases in the fourth lumbar vertebra. Extensive high voltage roentgen therapy was given to the affected lumbar area, with slight improvement of symptoms. About two months later there developed physical and roentgen evidence of metastatic tumors in the lungs. The patient died on Sept. 1, 1953. Permission for an autopsy was denied.

The consensus today is that clear cell carcinoma of the renal parenchyma rarely metastasizes to other parts of the genitourinary tract. This opinion has not always prevailed, for in the urologic and pathologic monographs on renal tumors published in the latter half of the nineteenth century one finds the oft-repeated, though unconfirmed, statement that renal parenchymal tumors may be propagated downward into the renal pelvis, ureter and bladder by a process of implantation or grafting. This erroneous conception may be attributed to the meager pathologic and histologic technics of that era, when secondary tumors resulting from the dissemination of papilliferous tumor cells from a papillary carcinoma of the renal pelvis were often incorrectly diagnosed as a "hypernephromatous" metastases or implants.

In the recent urologic textbooks this pathologic entity is either mentioned as a rare possibility or disregarded entirely. The incidence of such metastases in the literature is indicated in the accompanying table.

A search of the literature reveals only 61 authentic cases of clear cell carcinoma of the renal parenchyma or hypernephroma metastasizing to other parts of the genitourinary tract. The ureter was the site of metastatic tumor in 15 cases, viz., 13 positive cases[1] and 2 doubtful cases.[2] The bladder was involved in 8 cases, viz., 7 positive cases[3] and 1 doubtful case.[4] The corpora cavernosa of the penis was the site of metastases in 3 cases, the epididymis in 2 cases and the testes in 3 cases. In the female, hypernephromatous metastases have been observed in the vagina in 27 cases; in the vulvourethral area in 1 case; in the ovary in 2 cases, and in the uterus in 1 case.

Differential Diagnosis. — Knowledge of the pathogenesis of vesical and ureteral metastases from clear cell carcinoma of the kidney may be enhanced by a consideration of the various pathologic conditions that may be confused with or closely simulate the aforementioned lesions.

1. *Papillary Carcinoma of the Renal Pelvis with Vesical and Ureteral Metastases:* It has been estimated that primary neoplasms of the renal pelvis comprise between 5 and 10 per cent of all renal tumors and that 85 per cent of the pelvic neoplasms are papillary carcinoma and 15 per cent squamous cell carcinoma. Approximately one-third of papillary carcinomas of the renal pelvis are accompanied by secondary tumors of the ureter or bladder or both.[5]

There is no unanimity of opinion concerning the pathogenesis of these secondary tumors. Some authors, including Hanseman, Ewing, Broders, McDonald and Priestly, Fagerstrom and Bothe, regard the multicentric origin of the neoplastic process as the logical explanation

Statistical Reports of Metastatic Tumors in the Genitourinary Tract from Renal Clear Cell Carcinoma (Hypernephroma)

Author and Year	Primary Tumors of Renal Cortex		Secondary Tumors				
			Ureter	Bladder	Testis	Epididymus	Prostate	Scrotum
Albarran and Imbert,[6] 1903	Adenocarcinoma Hypernephroma	188 85 273		1				
Garceau, E.: Renal, Ureteral, Perirenal and Adrenal Tumors. New York and London: D. Appleton-Century Company, 1909	Hypernephroma	176		1				
Schlecht,[11] 1931	Hypernephroma	285	2					
Hand, J. R., and Binders, W.: J. Urol. 28:199, 1932	Carcinoma	193						
Convey, C. D.: Arch. Int. Med. 55:895, 1936	Carcinoma Autopsy Clinical	 46 46 92	1	1	1	1		
Mintz, E. R., and Gaul, E. A.: New York State J. Med. 39:1405, 1839	Carcinoma	127						
Kozoll, D. D., and Kirshbaum, J. D.: J. Urol. 41:435, 1940	Carcinoma	44	5					
Melicow, M. M., and Gile, H. H.: J. Urol. 40:637-640, 1940	Clear cell carcinoma Hypernephroma	 73 83 156			1	1	1	1
Nalle, B. C.: J. Urol. 57:662, 1947	Carcinoma	58	4	3				
Abeshouse,[8] 1954	Hypernephroma	105		1				
Tumor Registry, Armed Forces Institute of Pathology; Personal communication from Dr. Mostolfi, 1953	Hypernephroma	1,200		2				
Total		2,709	12	9	2	2	1	1

of these secondary tumors in cases of papillary carcinoma of the renal pelvis. The proponents of this theory maintain that more than one center in the urothelial tract is affected by endogenous or exogenous carcinogens, and that the resulting neoplastic processes may appear as synchronous or asynchronous, single or multiple, isolated or coalesced tumors. This theory appears to explain adequately the frequent occurrence of secondary vesical and ipsilateral ureteral tumors and the rare occurrence of secondary contralateral ureteral tumors, before or after operation, in cases of unilateral primary papillary carcinoma of the renal pelvis or ureter. It also explains the tendency of single or multiple vesical or ureteral tumors to develop in cases of so-called benign papilloma of the urothelial tract. Further sup-

port of this theory is supplied by the study of Kaplan, McDonald and Thompson (1951), who reviewed 133 cases of papillary carcinoma of the renal pelvis and found 88 single and 45 multiple tumors.[5a]

Other authors, including Albarran, Kimball and Ferris, Mackenzie and Ratner, and McAlpine,[6] attributed the development of multiple vesical or ureteral tumors in cases of papillary carcinoma of the renal pelvis as "graft implants" on the urothelial lining following the downward transportation of effete malignant cells by the urinary stream or by ureteral peristaltic action. The proponents of this theory maintain that it adequately explains the frequent development of papillary tumors in the bladder and in the lower third of the ipsilateral ureter, as well as the rare occurrence of tumors in the contralateral ureter in cases of papillary carcinoma of the renal pelvis. From an anatomic, physiologic or pathologic standpoint it is difficult to explain the attachment or implantation of loose malignant cells on the urothelial lining in the absence of obstruction and inflammation below the site of the primary lesion.

Implantation in a retrograde manner has been suggested by Mortensen and Murphy as the responsible mechanism, viz., tumor cells pass in the direction opposite to the urinary flow. This theory is not supported by repeated clinical or pathologic studies, which show that primary papillary neoplasms of the bladder are rarely accompanied by secondary tumors in the upper two-thirds of the ureter or the renal pelvis. These studies have shown that involvement of the lower third of one or both ureters in cases of primary papillary carcinoma of the bladder is the result of direct extension and infiltration of the neoplastic process rather than of ureteral reflux, lymphatic spread or implantation.

Multiple tumors of the bladder and ureter associated with papillary carcinoma of the renal pelvis exhibit the same histologic features as does the pelvic tumor, show a marked tendency to recur, respond poorly to fulguration or operation and eventually metastasize to adjacent and distant organs.

Squamous cell carcinoma of the renal pelvis exhibit a marked tendency to spread by direct extension or infiltration into the adjacent calyces and the upper part of the ureter. I have observed 2 cases in which extension into the upper part of the ureter occurred.

2. *Vesical and Ureteral Metastases from Other Renal Neoplasms:* There are very few reports in the literature of secondary vesical and ureteral tumors associated with other renal neoplasms, exclusive of clear cell carcinoma of the cortex and papillary carcinoma of the renal pelvis. Lattes[7] (cited by Melicow; see table) and Garrett and Mertz (1953) reported individual cases of vesical metastases associated with Wilms' tumor of the kidney. These secondary tumors are due to arterial dissemination or retrograde venous embolism rather than to retrograde lymphatic permeation or implantation.

3. *Vesical and Ureteral Metastases Associated with Primary Ureteral Tumors:* I have recently reviewed 198 primary malignant and 60 benign tumors of the ureter and observed secondary tumors of the bladder in 19 cases of malignant and 1 case of benign disease. In the latter case the tumor should be regarded as a malignant or potentially malignant neoplasm. Multiple tumors of the ureter were present in 24 cases of malignant and 4 cases of benign disease. It was practically impossible to determine whether or not these multiple tumors were primary or secondary, synchronous or asynchronous. All of the secondary tumors were of the papillary transitional cell variety.

4. *Metastatic Tumors of the Ureter and Bladder from Extrarenal Neoplasms:* In this article I have intentionally omitted the relatively common type of secondary vesical and ureteral tumors resulting from direct extension or infiltration from a primary carcinoma of the male or female pelvic organs, viz., prostate, seminal vesicles, bladder, uterus, cervix and ovaries. Attention is directed to those secondary tumors of the bladder and ureter which reach these organs by way of the blood stream or the lymphatics.

True metastatic tumors of the ureter are extremely rare. In 1951 McCrea and Pfeile[9] collected 41 cases, and I have gathered 27 additional cases.

True ureteral metastases are usually accompanied by metastases to other organs. The lesions are bilateral in approximately 60 per cent of the cases and involve the upper and the lower portion of the ureter with equal frequency.

Watson and his associates[10] reviewed the autopsy observations in 80 cases of lymphoblastoma and noted vesical metastases in only 5 cases of lymphosarcoma. Klinger[11] reviewed 5,000 autopsies and collected 142 cases in which there were secondary tumors in the genitourinary tract. In the majority of these cases (95) multiple portions of the urinary tract were involved. Vesical metastases were combined with other secondary tumors in the genitourinary tract in 33 cases and were unaccompanied by other secondary metastases in 13 cases. Klinger also observed 1 case of carcinoma of the kidney with metastases to the penis, causing priapism. Tumors of the ureters were involved in 7 cases; in 1 case alone and in the others combined with other secondary tumors. It is interesting to note that in none of the 66 cases of metastatic ureteral tumors collected by the author were the lesions associated with primary renal hypernephroma.

5. *Multiple Primary Tumors Involving the Kidney and/or the Bladder or Ureter:* The synchronous and asynchronous occurrence of multiple primary tumors within the genitourinary tract is uncommon but quite familiar to the experienced pathologist. The most common type of multiple primary tumors is a combination of two or more neoplasms involving the skin, the gastrointestinal tract and the breast.

Kretschmer (1938) reported 5 cases of multiple tumors involving the urinary tract.[12] In only 1 case were a papillary carcinoma of the bladder and a hypernephroma of the right kidney present. Kaminsky (1949) observed 3 cases of multiple tumors involving the kidney and the bladder.[13] Cases of adenocarcinoma of the renal cortex associated with a papillary carcinoma of the bladder have been reported.[14] Goldstein and Rubin (1948) reported an unusual case of a patient with 4 metachronous primary tumors from this clinic, viz., multiple papillary carcinoma of the bladder, adenocarcinoma of the sigmoid, right hypernephroma and basal cell carcinoma of the skin.[15]

In the majority of the aforementioned cases the vesical carcinoma presented the first important clinical symptoms, attention being drawn later to the renal tumor, which in some instances was discovered only at autopsy.

Pathogenesis.—There is no unanimity of opinion concerning the pathogenesis of bladder metastases in cases of clear cell carcinoma of the kidney. The following pathways have been proposed:

1. *Direct Extension:* The proponents of this theory have maintained that if an extrinsic neoplasm, i.e., rectal adenocarcinoma (Boger,[16] 1928), is capable of invading the urinary passages and giving rise to implants in these passages, the same capacity in a higher degree must be present in tumors indigenous to the urinary tract. This is pure theorizing, how-

ever, and is not consistent with the observations at operation and autopsy in large series of cases of neoplasms of the kidney in which there may be an occasional instance of a parenchymal neoplasm invading the renal pelvis—rarely, if ever, with continuous extension to the ureter or bladder.

2. *Urogenous Route:* It is generally acknowledged that the occurrence of secondary tumors of the ureter and bladder in cases of papillary carcinoma of the renal pelvis may be due either to the multicentric origin of such papilliferous tumors or to the implantation into the urothelium of the ureter or bladder of viable tumor cells from the primary pelvic tumor. Most recent writers consider the latter mechanism responsible for metastases to the ureter and bladder in cases of clear cell carcinoma.

The proponents of this theory offer the following evidence in favor of this mechanism: 1. Recent cytologic studies of the urinary sediment in cases of clear cell carcinoma and hypernephroma reveal a consistently high incidence of viable tumor cells in the urine of patients not surgically treated. 2. Viable tumor cells from parenchymal as well as pelvic tumors have been successfully transplanted from one species (man) to the eye of another (rabbit) by Green, Hovnanian and Deming.[17] 3. It is assumed that viable tumor cells are dislodged from the parent tumor before or during operation and are transported downward in the urine to become implanted in the urothelium of the obstructed or nonobstructed, inflamed or noninflamed ureter or bladder.

The following evidence is in opposition to this theory: 1. There is a marked disparity between the high incidence of tumor cells in the urine of patients with clear cell carcinoma and hypernephroma not treated by operation and the rare occurrence of secondary tumors of the ureter and bladder in a large series of patients at operation or autopsy. 2. In cases of clear cell carcinoma and hypernephroma, the dissimilarity in the histio-ontogenetic features of the parent tumor (derived from tubular epithelium) and the type of epithelium at the site of the secondary tumor (transitional cell urothelium) is certainly not conducive to the propagation by implantation of secondary tumors. 3. Operative trauma does not appear to be an important causative factor, for the condition has been observed in at least 3 nonsurgical patients with ureteral metastases; furthermore, it is veritably impossible to remove a large renal neoplasm by the lumbar, the transperitoneal or the transthoracic route without some degree of unavoidable manipulation of the tumor prior to ligation of the vascular pedicle and ureter, and yet one encounters very few cases of secondary tumor in the ureter and bladder, considering the countless number of nephrectomies performed for neoplasms. 4. An analysis of the reported cases indicates that obstruction and inflammation of the ureter and bladder were absent in practically all cases. Most large renal parenchymal tumors produce some degree of distortion of the pelviocalyceal system and displacement of the ureter on the affected side, and yet the accompanying urinary stasis rarely causes the implantation of viable tumor cells.

It is my opinion that some mechanism other than implantation is responsible for the development of secondary tumors in the ureter and bladder in cases of clear cell carcinoma or hypernephroma.

3. *Lymphogenous Route:* Several irrefutable facts militate against the acceptance of this mechanism: 1. In the reported cases there is a conspicuous absence of demonstrable evidence of involvement of the lymphatic vessels in the area immediately adjacent to the metastatic tumor. 2. Anatomically, direct or retrograde dis-

semination of tumor cells through the lymphatics is not very likely to occur, as the lymphatic drainage of the kidney, ureter and bladder do not form a continuous system. 3. The lymphatic drainage of the kidney, ureter and bladder is directed outward to the lymph nodes adjacent to the renal artery, the abdominal aorta and the common iliac and its two component arteries.

4. *Hematogenous Route:* Theoretically the hematogenous dissemination of tumor cells of a neoplasm of the renal parenchyma may be brought about in several different ways: (1) direct invasion of the renal venous system with extension into the inferior vena cava and heart, with subsequent dissemination to all parts of the body; (2) direct invasion of renal vessels (arteries and veins) and extension within or along the outer walls of these vessels as they pass out from the hilum and course down over the pelvis and ureter; (3) secondary and tertiary embolism; (4) retrograde venous embolism; (5) paradoxical embolism; and (6) extension through the lymphatics draining the kidney into the adjacent lymph nodes, thence into the thoracic duct and finally into the venous system (subclavian vein).

Some writers, including Scott, concede the rarity of clear cell carcinomatous and hypernephromatous metastases to the ureter and bladder and attribute the unusual localization of such secondary tumors to the vagaries of venous dissemination. A much more logical explanation of this rare pathologic phenomenon, however, may be found in the retrograde venous embolism.

Willis[18] (1934) and Martzloff and Manilove[19] (1949) have stressed the role of retrograde venous embolism in the development of metastases to the ureter, bladder, pelvic organs and genitalia in both male and female in cases of renal parenchymal neoplasms, particularly on the left side. Anson and his associates[20] (1940, 1947, 1948) have observed marked differences between the venous drainage of the right and left kidney which are not recognized or appreciated by the pathologist and urologist. They noted that the left sex vein (ovarian or spermatic) always joined the left renal vein, whereas this termination occurred on the right side in only 21 per cent of cases. They also showed that the left renal vein is the center of an intricate venous network. In 68 per cent of cases, the left renal vein was found to communicate with the adrenal, visceral, diaphragmatic and lumbar venous components, whereas the latter venous components terminate in the inferior vena

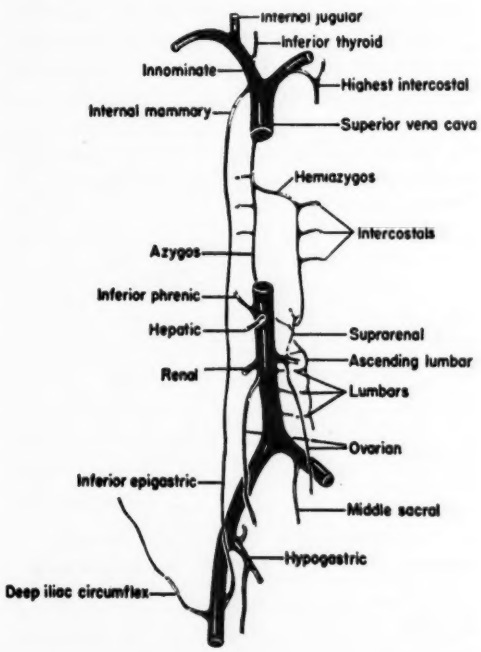

Fig. 1.—Diagram showing the chief branches of the venous tree. Parallel with the main inferior vena cava, superior vena cava stem. Four additional pathways extend along the long axis of the trunk. These are the epigastric-mammary, thoracic-epigastric, lumbar-hemiazygosazygos and the internal vertebral systems. The second and fourth systems are not shown in the diagram. *(Reproduced from Quiring's Collateral Circulation, Lea & Febiger, 1949, Fig. 40).*

cava rather than in the renal vein on the right side (Fig. 1). Furthermore, Batson[21] (1940) has demonstrated an elaborate system of vertebral veins possessing no valves but communicating with the renal, portal and peripheral circulations. I have been able to demonstrate widespread communications between the pelvic venous system and the visceral, lumbar, spermatic and lower limb venous components after injection of the dorsal vein of the penis.

By means of the aforementioned widespread venous communications, the left kidney is brought into intimate relation with the following structures: (1) the diaphragm, ribs, intercostal muscles, lungs, pleura and pericardium; (2) the renal capsule, perirenal fat and fascia, suprarenals, peritoneum; (3) the lumbar and dorso-axial muscles; (4) the vertebrae, spinal cord and meninges; (5) the pelvic viscera, musculature and bones; (6) the ureter and bladder; (7) the male and female genital organs; (8) the fascia and skin of the abdomen, back and perineum, and (9) the lower extremities.

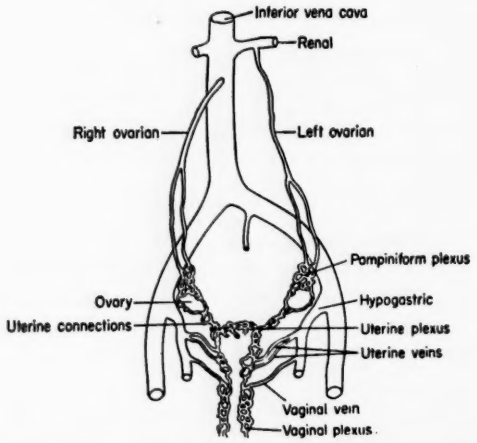

Fig. 2. — Diagram showing the vaginal, uterine and ovarian collateral venous pathways. These venous channels parallel the arterial vessels to the same areas. Retrograde venous embolism may extend directly from the left renal vein to the ovarian vein and thence on to the pampinoform, uterine or vaginal plexuses and veins. *(Reproduced from Quiring's Collateral Circulation, Lea & Febiger, 1949, Fig. 45).*

It is readily apparent that any increase in intra-abdominal pressure, such as that caused by straining at stool or voiding, coughing, sneezing, etc., may dislodge tumor emboli from any one of the intrarenal or extrarenal venous components and produce a paradoxical venous tumor metastasis, i.e., by-passing the pulmonary, portal and caval venous circuits.

In the same manner, tumor emboli involving the left ovarian vein may extend by retrograde embolism to the pampiniform or ovarian plexuses or to the parametrial (uterine) or vaginal veins to reach any of the female pelvic organs or external genitalia (Fig. 2). In the male, tumor emboli from the renal vein may extend into the left spermatic vein and the pampiniform plexus of the spermatic cord and, by virtue of the communications with the pelvic venous system supplying the ureter, bladder, prostate, seminal vesicles, testes, spermatic cord, scrotum and scrotal skin, may subsequently involve any one or more of these organs.

It is difficult to attribute to mere chance or coincidence the fact that the left kidney was the site of the primary parenchymal neoplasm in 8 of 12 cases of ureteral metastases (site of primary neoplasm was not given in 3 cases), in each of 8 cases with vesical metastases, in each of 3 cases with penile metastases, in each of 2 cases with epididymal metastases, in 2 of the 3 cases with testicular metastases, and in 20 of 25 cases with vaginal metastases.

SUMMARY

Two proved cases of clear cell carcinoma of the kidney with metastases to the bladder are reported, and a brief discussion of the incidence and pathogenesis of this tumor is presented. Clinical, pathologic and anatomic evidence is offered in support of the author's contention that the

mechanism responsible for the development of secondary tumors in other parts of the genitourinary tract in cases of primary clear cell carcinoma or hypernephroma of the renal parenchyma is retrograde venous embolism rather than implantation of viable tumor cells excreted or expressed into the urine. There is no evidence to support the view that the incidence of ureteral and vesical metastases is greater in cases of clear cell carcinoma or in cases of hypernephroma with papilliferous or pseudopapilliferous histologic features.

ZUSAMMENFASSUNG

Es wird ueber zwei Faelle von Hypernephrom mit Metastasen in der Harnblase berichtet. Die Haeufigkeit des Vorkommens und die Pathogenese dieser Nierengeschwulst werden kurz eroertert. Der Verfasser belegt mit klinischen, pathologischen und anatomischen Unterlagen seine Ansicht, dass für die Entstehung sekundaerer von einem primaeren Hypernephrom oder parenchymalen Nierenkrebs ausgehender Geschwuelste in anderen Abschnitten des Harn-und Geschlechtsapparates ein retrograder venoeser Embolus eher verantwortlich zu machen ist als eine Implantation lebender Geschwulstzellen, die in den Harn ausgeschieden oder ausgepresst werden. Es gibt keine stichhaltigen Gruende anzunehmen, dass die Haeufigkeit von Hypernephrommetastasen in den Harnleitern und der Blase davon abhaengt, ob es sich histologisch um eine papillentragende oder eine pseudopapillaere Geschwulst handelt.

RIASSUNTO

Vengono riferiti tre casi di carcinoma del rene a cellule chiare con metastasi vescicali. Viene trattata la frequenza e la patogenesi di questo tumore, assieme alla sintomatologia e ai quadri anatomopatologici che giustificano la teoria dell'autore secondo la quale le metastasi dal rene ad altri punti del tratto urinario avvengono per via venosa retrograda piuttosto che per via urogena. Non vi sono dimostrazioni a sostegno di una maggior frequenza di metastasi ureterali o vesicicali nel tumore a cellule chiare piuttosto che nell' ipernefroma con aspetti papilliferi o pseudo papilliferi.

RÉSUMÉ

L'auteur présente deux cas vrais de cancer *"a clear cell"* du rein avec métastase à la vessie urinaire et il parle brièvement de la fréquence et la pathogénèse de cette tumeur. Il offre aussi des faits cliniques, pathologiques, et anatomiques dans son effort de démontrer que le méchanisme responsable pour le développement des tumeurs secondaires aux cancers du parenchyme du rein a *"clear-cell"* ou celui de l'hypernéphrome est plutôt une embolie veineuse rétrograde qu'une implantation de cellules cancereuses viables, excrétées ou pressées dans la vessie. Selon l'auteur, on ne peut pas, de ce que nous connaissons a présent, démontrer que la fréquence des métastases à l'uretère et à la vessie est plus grande lorsq'il s'agit de cancer à *"clear-cell"* ou lorsq'il s'agit des cas d'hypernéphrome characterisés histologiquement comme papillifères ou pseudopapillifères.

SUMÁRIO

São apresentados dois casos comprovados de carcinoma de celulas claras do rim, com metastases à bexiga, com uma breve discussção da incidencia e da patogenia deste tumor. São oferecidas indicações clinicas, patologicas e anatomias em apoio da opinição do autor de que o mecanismo respondavel pelo desenvolvimento de tumore secundarios em outras partes do tracto genitourinario em casos de carcinomas primarios de celulas claras ou hiper-

nefromas do parenquima renal é mais o embolia venosa retrograda do que a implantação de celulas tumorais viaveis excretadas ou lançadas na urina. Não há provas que apoiem o ponto de vista de que a incidencia de metastases ureterais e vesicais seja maior em casos de carcinoma de celulas claras ou em casos de hipernefroma com aspectos histologicos papiliferos ou pseudopapiliferos.

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History, science, and philosophy all make us aware of the great collective achievements of mankind. It would be well if every civilized human being had a sense of these achievements and a realisation of the possibility of greater things to come, with the indifference which must result as regards the petty squabbles upon which the passions of individuals and nations are wastefully squandered.

—*Russell*

Editorial

Advantages of One-Stage Resection of Esophageal Diverticula

EITHER esophageal diverticula are more common than they formerly were, or more of them are discovered in the course of routine roentgen studies of the esophagus.

Many small diverticula give only occasional trouble, but as they increase in size they cause increasing difficulty in swallowing, and regurgitation of food occurs.

In the presence of a well developed diverticulum of the esophagus there is some difference of opinion as to the proper manner of dealing with the defect.

Primary resection in one stage, with immediate closure of the esophageal opening, is certainly the most desirable treatment. There are, however, several details in the technic that may greatly facilitate a smooth, uncomplicated recovery. Reviewing the literature, I am amazed at the great variation in methods of dealing with these rather uniform conditions.

In selecting diverticula for one-stage resection, one must be sure that the rules pertaining to this type of operation are not violated. No patient in whom the sac is the seat of recent inflammatory change should be accepted for single-stage resection. A patient who has recently undergone endoscopic study presents a hazard. I have had occasion to operate on a very sick patient with a diverticulum that had been perforated accidentally during esophagoscopic examination. The accident was not immediately recognized, and leakage of the contents of the sac into the mediastinum set up a distressing series of complications. Mediastinitis developed, and, a little later, purulent pleuritis. Exposure of the perforated diverticulum and its anchorage in the upper angle of the wound was followed by rapid improvement of the mediastinitis and pleuritis. Obviously, one would not venture upon resection with such a patient.

If conditions warrant a single-stage diverticulectomy, I have found the following technic practically free of annoying complications:

1. The incision, 2½ or 3 inches (6.3 to 7.5 cm.) long, centered at the lower margin of the cricoid cartilage, is made along the anterior border of the sternomastoid muscle on the side of presentation of the diverticulum.

2. The cervical fascia is opened along the anterior border of the sternomastoid muscle, after which the muscle is retracted laterally to expose the carotid sheath. It is usually possible to retract the omohyoid muscle medially without division.

3. The carotid sheath is freed, and the lateral margin of the thyroid gland is exposed by division of the sternothyroid musculofascial layer. This permits lateral retraction of the contents of the carotid sheath with a ribbon retractor and medial retraction of the thyroid, larynx and trachea.

4. The loose areolar tissue between the thyroid and the carotid sheath is then opened with a Kocher dissector, which is an ideal instrument for this and other steps involving blunt dissection in the neck. The inferior thyroid artery is encountered at this point; this vessel is

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ligated and divided if it interferes with exposure.

5. If the lateral margin of the esophagus is now visible, the position of the diverticulum can be established by recalling that its neck is at the level of the cricoid cartilage, whereas the sac extends downward between the posterior wall of the esophagus and the prevertebral fascia.

6. Gentle traction on the diverticulum with nontraumatizing forceps will deliver the sac into the wound for inspection and appraisal.

7. When the neck of the diverticulum has been exposed, gentle traction and lifting will make it possible to rotate the pharyngo-esophageal junction and bring it into view. Rotation of the trachea and esophagus in their longitudinal axes affords better visualization of the proximal edge and does not endanger the recurrent laryngeal nerves.

8. The muscle fibers are swept away from the neck of the sac in a manner to preserve as many fibers as possible for the ensuing repair. In defects superior to the cricopharyngeus portion of the inferior constrictor muscle, the fibers below the neck of the sac form a heavy transverse band, which is not present in diverticula originating below the cricopharyngeus.

9. After careful delineation of the neck of the diverticulum, fine forceps are applied transversely at the lateral margin of the juncture of the pharynx or esophagus and the diverticulum. A knife is used to divide the tissue proximal to the forceps. This initial opening through the esophageal mucosa and submucosa is closed with one or more interrupted fine silk sutures.

10. A second pair of forceps is applied just beyond the first, care being taken to keep in the same transverse plane and to follow the normal convexity of the posterior esophageal wall.

11. As further forceps are applied subsequently and the tissue is divided proximal to them, the opening in the esophagus is closed by carefully spaced through-and-through interrupted sutures until the entire diverticulum has been removed.

This methodical clamping, incision and suturing result in secure closure of the defect without constriction of the lumen. No devitalized or crushed tissue is left in the suture line. The mucosal edges are well apposed, and the submucosal layer is held under even tension. The importance of suturing fresh, viable tissues that have not been injured or impaired by clamps, escharotics or cautery is strongly emphasized. It is likewise important to avoid the use of continuous or purse-string sutures, because they have a tendency to narrow the lumen of the esophagus.

12. The muscle fibers of the cricopharyngeus and the uppermost fibers of the esophagus are closed over the first suture line with interrupted silk sutures.

13. A small, soft rubber drain may be brought out from the lateral margin of the thyroid gland to provide a pathway of escape for blood or serum, as well as for any leakage that may occur. The drain must not be left adjacent to the suture line in this or any closure or anastomosis of the alimentary tract. The drain would inhibit reparative processes by carrying the normal plastic exudate away from the suture line.

In this procedure one can visualize the danger of injury to the recurrent laryngeal nerve if one fails to recognize its proximity to the lateral margins of the diverticulum. When the sutures are placed transversely across the neck of the sac there is little tendency to the formation of stricture at this level. I have had no occasion to use esophageal bougies to dilate the esophagus after operation.

There are some points in the operation suggested here that, in my opinion, should be emphasized. In closing the neck of the sac, the sutures must carefully approximate the mucosal layers without tension. The use of fine interrupted silk sutures, which are evenly spaced and the knots tied with ends within the esophagus, is satisfactory. The constrictor muscles and the longitudinal muscles of the esophagus should be deployed over the closed defect

in a manner to aid in the closure. It may be an unnecessary refinement, but I prefer to divide the neck of the sac with a very sharp knife rather than with scissors. In no instance are the edges of the defect crushed, cauterized or unnecessarily traumatized. One layer of evenly spaced interrupted sutures is sufficient for adequate closure of the neck of the diverticulum.

When the operation is near completion it may be judicious to place a small rubber wick in the lower skin angle, but one should never place a gauze wick in the vicinity of the sutures in the esophagus, because its presence would tend to remove the exudate that is essential in the healing process at the closure site.

I like to introduce a fine indwelling Levine tube before the operation and leave it in place for several days. If difficulty is encountered in passing this tube preoperatively, one should not persist, for fear of perforating the diverticulum. It is much safer and easier to direct it into the distal portion of the esophagus during the operation.

Intratracheal anesthesia is the form I usually employ.

The technic is not difficult if one takes advantage of the mobility of the esophagus. If the patient was greatly depleted before the operation, the indwelling nasal catheter may be used to introduce liquid nourishment by the continuous drop method. When the patient objects to the indwelling tube it may be removed, but feeding should not be indulged in until after the seventh day, and even then only small amounts of liquid are given at hourly intervals for several days. Succumbing to the entreaties of the patient for early feeding is the greatest hazard to the security of the esophageal repair.

RAYMOND W. MCNEALY,
F.A.C.S., F.I.C.S., Chicago, Illinois

The world turns aside to let any man pass who knows whither he is going.

—Jordan

Though ambition itself be a vice, it is often the cause of great virtue. Give me that wit whom praise excites, glory puts on, or disgrace grieves; he is to be nourished with ambition, pricked forward with honour, checked with reprehension, and never to be suspected of sloth.

—Jonson

The mind celebrates a little triumph whenever it can formulate a truth.

—Santayana

New Books

Books Received.—The following books have been received by the Editor; they will be reviewed critically as space and facilities permit. Omission of more extended review, however, is not to be taken as criticism of the merit of the book.

J.A.M.A. Clinical Abstracts of Diagnosis and Treatment. Selected by Noah J. Fabricant. New York and London: Grune, Stratton, Inc., 1955. Pp. 627 including index.

Operative Technics in General Surgery. Edited by Warren H. Cole, with an introduction by Frank H. Lahey. Thirty-seven contributors. New York: Appleton—Century-Crofts, Inc., 1955. 2d ed. Pp. 973, with 524 illustrations and 2 color plates. Reviewed in this issue.

Cardiovascular Surgery. Henry Ford Hospital International Symposium. Edited by Conrad R. Lam. Philadelphia and London: The W. B. Saunders Company, 1955. Pp. 542.

Chirurgie du Corps Thyroide. By Sylvain Blondin. Paris: G. Masson et cie, 1955. Pp. 292, with 37 illustrations.

Applied Medical Bibliography for Students. By William Dosite Postell. American Lecture Series No. 259. Springfield, Ill.: Charles C Thomas, Publisher, 1955. Pp. 142.

Ophthalmology. Edited by Paul C. Craig. Fort Pierce Beach, Florida: The Froben Press, 1955. Published as a memorial to the late Dr. Otis R. Wolfe.

Peripheral Nerve Injuries. Edited by H. J. Seddon. Medical Research Council Special Report, Series No. 282. London: Her Majesty's Stationery Office, 1954. Pp. 451, with 276 illustrations.

New Concepts in Surgery of the Vascular System. By Emile Holman. Springfield, Ill.: Charles C Thomas, Publisher, 1955. Reviewed in this issue.

Textbook of Endocrinology. Edited by Robert H. Williams. Philadelphia: The W. B. Saunders Company, 1955. 2d ed. Pp. 776, with 173 illustrations.

Intracranial Gliomata. By John Penman and Marion C. Smith. Medical Research Council Special Report Series No. 284. London: Her Majesty's Stationery Office, 1954. Pp. 70, with 56 tables. Reviewed in this issue.

El Dranaje en Cirugía. Por Domingo Prat. Montevideo, Imprenta Rosgal, 1954. Pp. 166. Illus.

Atlas of Rush Pin Technics. By Leslie V. Rush. Meridian, Miss.: The Berivon Company, 1955. Pp. 227. Reviewed in this issue.

La Valvola Mitrale: Aspetti anatomici, fisiologici, clinici e chirurgici. Per Michele A. Chiechi e Charles P. Bailey. Rome, Pensiero Scientifico, 1954. Pp. 561. Illustrated.

Sindromi Dolorse dopo Interventi Gastrici e loro Terapia Chirurgica. Per Luigi Leopoldo Bracca. Torino, Minerva Medica, 1952. Pp. 178. Plates.

Praktische Anatomie. By T. von Lanz W. Wachsnuth. Berlin: Springer, 1954. Pp. 549, with 321 illustrations. Reviewed in this issue.

Physiology and Anatomy. By Esther M. Greisheimer. Philadelphia: The J. P. Lippincott Company, 1955. 2d ed. Pp. 868, with 430 illustrations, 48 in color.

The Back and Its Syndromes, Including Injuries, Diseases, Deformities and Disabilities. By Philip Lewin. Philadelphia: Lea & Febiger, 1966. Pp. 942, with 371 illustrations.

The Shoulder and Environs. By James E. Bateman. St. Louis: The C. V. Mosby Company, 1955. Pp. 565, with 376 illustrations.

BOOKS REVIEWED

Operative Technics in General Surgery. Edited by Warren H. Cole, with an introduction by Frank H. Lahey. New York: Appleton—Century-Crofts, Inc., 1955. 2d ed. Pp. 973, with 524 illustrations and 2 color plates.

The second edition of Dr. Warren H. Cole's *Operative Technics in General Surgery* more than meets all expectations as to soundness of content and brilliance of presentation. Its twenty-six chapters are the work of thirty-seven contributors, each a surgeon of high distinction in his particular field. The late Dr. Frank H. Lahey, who contributed the introduction, commented aptly on this galaxy of surgical talent: "The names of these various authors appear frequently in the world literature . . . They are still young enough to be flexible in their viewpoint . . . they are, however, sufficiently mature to have had time and opportunity to acquire a volume of experience which makes them capable of presenting their subject with authority."

The titles of the successive chapters are as follows: *Wound Healing and the Care of Wounds; Hemorrhage and Shock; Blood Transfusions and Allied Problems; Burns; Preoperative and Postoperative Care; Amputations; The Esophagus; Abdominal Incisions; Surgery of the Stomach and Duodenum; Gastric Vagotomy in the Treatment of Peptic Ulcer; Surgery of the Small Intestine; Gastrointestinal Surgery in Infancy and Childhood; The Pancreas and the Adrenals; The Gallbladder and Bile Ducts; The Liver and Subphrenic Space; The Colon; The Appendix; The Lower Part of the Sigmoid; the Rectum and Anus; The Lymphatic System; The Spleen; Abdominal Hernia; The Breast; The Thyroid and Parathyroid Glands; The Muscles, Fasciae, Tendons and Bursae; Surgery of the Hand and Its Tendons,* and *The Skin and Subcutaneous Tissue.* The list of titles itself indicates Dr. Cole's success in gathering material suitable to his principal intention, which, to quote from his preface, was to assemble material on "subjects more strictly in the realm and of interest to the general surgeon but which will be valuable to the young surgeon training in the various specialties of surgery." Three entirely new chapters are included: those on blood transfusion, gastrointestinal surgery in infancy and childhood and the appendix.

As Dr. Lahey has pointed out, the immense value of this work lies in its comprehensiveness, its thoroughness, its advanced outlook and the fact that the various subjects are dealt with by men who have had an abundance of personal experience therein. "My own long and rather large experience," he said, "has taught me that . . . it is impossible for a surgeon to attain great technical skill in any given operative procedure except by a special interest in the procedure and by performing it again and again."

The arrangement of the book is admirable; there is no attempt to equalize the length of the various chapters, and each subject, therefore, determines the amount of material presented. This is as it should be; it achieves a natural and logical rather than an artificial balance, and the reader is spared the irritation of "padding."

The writing and the illustrations, on the whole, are excellent. Each chapter is abundantly documented with references to the literature, and a comprehensive index is appended. The work is a necessary part of the library of every general surgeon and should be made available to students and young surgeons everywhere. Nor will the specialist find it wanting in either enjoyment or value, for there are innumerable areas of surgical knowledge which, although studied in most intricate detail by the general surgeon, are fundamental to the building up of skill in a specialized area. In an age of specialization carried, in some instances, to unnecessary extremes, it is well for all surgeons to keep these basic principles in mind. By its very nature, the new edition of Dr. Cole's superb compendium will contribute significantly as a counterbalance to overspecialization.

M. T.

New Concepts in Surgery of the Vascular System. By Emile Holman. Springfield, Ill.: Charles C Thomas, Publisher, 1955.

This excellent little monograph by a well known surgeon and research worker is a pleasure to read. It consists of two parts; the first is a lecture honoring Dr. David W. Yandell of Louisville, Kentucky, and the second is a lecture honoring Dr. Arthur Dean Bevan of Chicago.

The first part, entitled "The Immediate and Late Treatment of Arterial Injuries," summarizes the changes in surgical handling of

vascular injuries. Dr. Holman describes the success of arterial repairs as due to antibiotics, to special vascular instruments, such as Pott's clamps, to the rapid return of injured persons to places where definitive operations can be done, and finally to the development of grafting procedures. He also describes the treatment for arteriovenous fistulas, in which it is obvious that he has had much experience.

The second part of this monograph is entitled "The Pathologic Physiology of Poststenotic Dilatation: Its Significance in the Development of Arterial Aneurysms." To those of us who have heard Dr. Holman present this material in lecture form it is a joy to read it in book form. His material will probably be a classic of our times. His research is a model for other investigators.

By his simplification of the problems in the experimental laboratory Dr. Holman has demonstrated that relentless pressures eventually cause dilatation and aneurysm by structural fatigue. The relentless pressure is due to the intermittent jets due to systole and to turbulence of flow beyond the stenotic area. These phenomena, previously thought to be due to nervous or sympathetic imbalance, are demonstrated by Dr. Holman to be due to purely physical laws and are present in the poststenotic dilatation of coarctation of the aorta, as well as in poststenotic dilatation of the peripheral arteries.

This is a classic piece of work. It should be not only read but studied by all those interested in vascular fluid phenomena.

HERBERT D. TRACE, M.D.

Intracranial Gliomata. By John Penman and Marion C. Smith. Medical Research Council Special Report Series No. 284. London: Her Majesty's Stationery Office, 1954. Pp. 70, with 56 tables.

This short monograph is a detailed statistical analysis of 298 cases of histologically proved intracranial gliomas. These are divided into five pathologic groups, viz., glioblastomas, 163 patients; astrocytomas, 99 patients; oliodendrogliomas, 14 patients; medulloblastomas, 20 patients, and ependymomas, 2 patients. The records of these patients were taken from the neurosourgical records of St. George's Hospital for the ten-year period from August 1937 to August 1947, and the minimum period of follow-up for patients who survived for this period was twenty-four months.

It is of considerable interest that three-fifths of the skull films were considered abnormal. It appears that the value of roentgenograms of the skull is overshadowed by other diagnostic procedures, especially ventriculographic study. It must be remembered that taking roentgenograms of the skull is not painful or dangerous, something that cannot be said for the more informative ventriculographic or angiographic studies. The authors recognize the fact that the whole duration of the illness, or the survival period from the onset of the illness, is more significant than the survival period after admission to the hospital. Of 85 patients who survived more than twelve months after treatment, 52 were considered to have had a useful or worthwhile survival period. These patients represented 10 per cent of the glioblastomas, 34 per cent of the astrocytomas, 21 per cent of the oligodendrogliomas and 5 per cent of the medulloblastomas.

The authors conclude that the three most important factors in determining length of survival with intracranial glioma are the age of the patient, the site of the tumor and the pathologic type. Youth and long survival were strongly associated.

In adults the cerebral hemispheres are more favorable to long survival than the cerebellum; in children the reverse is true. The results of irradiation could not be assessed for lack of controls, and a controlled clinical trial of irradiation is suggested. As the authors state, 296 seems a large number of cases, but subdivision according to age of patient, pathologic picture, site of tumor and type of treatment soon brings the individual groups down to a size expressed by single figures. This is a valuable monograph, nevertheless, that should be carefully studied by everyone interested in intracranial gliomas.

HAROLD C. VORIS, M.D.

Atlas of Rush Pin Technics. By Leslie V. Rush. Meridian, Mississippi: The Berivon Company, 1955. Pp. 227.

The material presented here deals in its entirety with a system of treatment of fractures of the long bones, utilizing the intramedullary pin designed by Dr. Leslie Rush. An adequate basis for evaluation of this technic is provided by a large group of patients (approximately 700) treated at the author's hospital.

As the author himself points out, the presentation of material is unorthodox. There is no index and no bibliography. The text

is divided into three sections: Part 1 is concerned with general considerations, the technic of insertion of the pin. The indications for its use, the dynamic factors involved, and methods of reducing the fractures and achieving stability of fixation. Part 2 deals with the lower extremity and Part 3 with the upper extremity. Specific cases of fracture, ranging from rather simple to extremely difficult types are described in detail and illustrated with roentgenograms.

The text is also profusely illustrated with diagrams and line drawings. These are clear and accurate and are extremely helpful in clarifying pertinent points and refinements of technic. Certainly the manner of presentation enables the reader to understand and absorb the subject quickly and easily. Unfortunately, as is usually true of diagrammatic presentations, the treatment of the more difficult fractures may appear not at all difficult to the uninitiated eye. In addition, partly because of the profuse illustrations and partly because of the unorthodox method of presentation, there is an occasional loss of continuity of thought. These minor objections detract but little from the obvious value of the book, which presents in lucid detail a thoroughly tested method of intramedullary fixation. Certainly both the book and its subject, the Rush pin, can be highly recommended for detailed study by all who are called upon to treat fractures frequently.

ALLAN B. HIRSCHTICK, M.D.

Praktische Anatomie. By T. von Lanz W. Wachsmuth. Berlin: Springer, 1954. Vol. 1. Pp. 549, with 321 illustrations.

This volume of *Praktische Anatomie* deals with the neck. It is an excellent atlas which results from much planning, assembling of material and collaboration between artist and authors. Throughout this work one is impressed with the tridimensional presentation of the illustrations; particularly outstanding are those appearing on page 188.

This reviewer would take issue with a point in respect to the middle layer of deep cervical fascia as related to the thyroid gland. The material herein presented fails to emphasize the important practical point that this layer of fascia is attached to the lateral aspect of each thyroid lobe. This criticism is mentioned with no intent to detract from the praise due to this worthy tome.

Rarely will one see such masterful reproductions. The work can be recommended unreservedly to anyone interested in the subject of anatomy, applied or otherwise. It is unfortunate that more books do not attain to these standards.

PHILIP THOREK, M.D.

Histologische Geschulstdiagnostik: Systematische Morphologie der menschlichen Geschwulste als Grundage fur die klinische Beartellung (Histologic Diagnosis of Tumors: Systematic Morphologic Studies of Tumors in Man as a Basis for Clinical Judgment). By A. von Albertini. Stuttgart: Georg Thieme Verlag, 1955. Pp. 544, with 638 illustrations.

This book is divided into two parts. Part 1 is a consideration of the general and special histogenesis of tumors, including their general morphologic aspects and the terms used to describe them. Part 2 deals with the diagnosis of tumors according to anatomic location.

One can only admire the author's thorough knowledge of the material presented and of the literature cited. Dr. Albertini, who certainly is an authority on the pathologic nature of tumors, leans backward to do justice to the opinions of pathologists that differ from his own.

Most readers will readily admit that this is one of the most beautifully written and fascinating books available on tumor pathology. One may differ with the author on certain subjects, but in general all controversial topics are masterfully handled. The book can easily be read even by one who does not know the German language perfectly. All in all, it belongs on the same level as did the famous earlier work of Ewing.

JEROME J. MOSES, M.D.

Abstracts from Current Literature

The By-Pass Operation in the Treatment of Arteriosclerotic Occlusive Disease of the Lower Extremities. Crawford, E. S., and DeBakey, M. E., Surg., Gynec. & Obst. 101:529, 1955.

During the past few years, surgical approach to arteriosclerotic segmental occlusive disease of the peripheral arteries has been directed toward reestablishment of blood flow through the main arterial channels by endarterectomy, excision and graft replacement of the occluded segment and by-pass of the diseased area with a graft. Important factors concerned are: first, the presence of an adequate patent peripheral arterial bed for the ready and unimpeded outflow of blood, and second, the performance of the procedure in a manner that will minimize tissue damage and interference with the collateral circulation. Arteriographic studies show not only the limits of the occlusive process but the character of the peripheral arterial bed. The procedure should be directed toward restoration of a strong pulsatile blood flow into the peripheral arterial bed, yet its performance should be associated with minimal jeopardy to the existing circulatory and functional capacity of the extremity to prevent edema, neuralgia and wound infection or subsequent thrombosis. Endarterectomy, except for very short occlusive lesions, too frequently lead to postoperative thrombosis. Complete excision with homograft replacement of an occluded segment is an extensive procedure, with increased likelihood of injury to nerves, lymphatics and adjacent veins. The type of by-pass operation generally employed may destroy collateral vessels.

To avoid this disadvantage and to obviate complete loss of circulation by thrombosis subsequent to endarterectomy or excision with homograft, the authors use the by-passing operation originally described by Kunlin and his associates, by anastomosing a graft into the side of the host artery above and below the diseased segment, through two small separate incisions connected by a tunnel made by blunt dissection or with a vein stripper. A detailed account of their technic with illustrations follows. They then report that blood flow through the main arterial channel distal to an occlusion was successfully reestablished in 37 of 40 extremities so treated. Success was determined arteriographically or by the presence of palpable pulses distal to the block that were absent prior to operation. The 3 failures occurred with borderline candidates as was indicated by small distal patent segments with secondary occlusions below. None of the patients was made worse by the operation.

The indication for surgical intervention in the 37 successful cases was intermittent claudication in 29; gangrene of limited degree in 7 and extensive gangrene in 1. Among the patients with gangrene, painful ischemic ulcers were present in 2 and severe rest pain in 6, and in 1 a digit had been destroyed by associated infection. The maximum period of observation was eighteen months. At the time of writing there had been no recurrence of difficulty. No deaths occurred and complications included a superficial wound infection in 1 patient and, thrombophlebitis, complicated by a small pulmonary infarct, in another. Reconstituted lyophilized arterial homografts with the ends slightly beveled were used as grafts.

WARREN A. YEMM, M.D.

Late Results Following Endarterectomy. Barker, W. F., and Cannon, J. A., Surg., Obst. & Gynec. 63:562, 1955.

The authors report experience with endarterectomy in 17 patients two years ago. Since that time they have done 42 operations on 41 patients and conclude that they are selecting their patients more carefully through an increase in their ability to predict which patients will be decidedly improved. They select the candidate on the basis of clinical signs of arterial insufficiency and pulse deficit in patients whose condition has been evaluated on the basis of angiograms and on the status of their cerebral, coronary and renal circulation. Patients in whom the upper level of the block is above the popliteal artery are subjected to exploration of that artery (or exploration at the level of the bottom of the "obstruction" if this has been seen on a preoperative film). Success is estimated at that time on the extent of intimal thickening in the vessel exposed, the patency of the distal arterial tree as demonstrated angiographically and the diameter of the vessel.

The operative technic consists of appropriate exposure of the upper and lower levels of the atherosclerotic obstruction, with excision of the diseased intima and its contained secondary clot by means of dissection in a plane in the innermost layers of the media, with repair of the artery as a tube of raw media. A smooth transition from the endarterectomized vessel to the normal artery and the use of heparin, together with the rapidity of blood flow, indicates the maintenance of a patent lumen.

In 27 of the 42 cases the results were favorable. Twenty-five of the 27 were excellent, with relief of symptoms of arterial insufficiency and return to pulses beyond the endarterectomized segment. The 2 failures, in the authors' opinion, could have been avoided by performing a more extensive endarterectomy at the time of the original operation. Follow-up investigation (for two years or more) of the 5 patients who originally obtained good results indicates that all of these have maintained the improvement present immediately after operation. One has been observed for thirty-eight months.

Complications encountered included significant bleeding in 5 cases, in 2 of which reexploration was required. Deep venous thrombosis occurred in 3 instances with no pulmonary emboli being recognized. Two patients had significant wound infections. In a third patient, homologous serum jaundice developed with separation of the skin edges. This patient was 1 of those with venous thrombosis. One instance of aneurysmal dilatation of the femoral artery has been observed, and in another case the patient had myocardial infarction three months after a satisfactory endarterectomy.

There have been no deaths in the series. Poor results are certain to follow generalized arteriosclerosis, diffuse distal arteriosclerosis and a thick intimal flap at the distal end of dissection. The onset of claudication and identification of a pulse deficit should be taken to indicate prompt arteriographic study.

WARREN A. YEMM, M.D.

Lithopedion. Nesbitt, R. E. L. Jr., U. S. Armed Forces M. J. 6:903, 1955.

In certain lower animals lithopedion formation *in utero* is relatively common, the fetus being retained in the uterus for a long time, with subsequent deposition of lime salts. It is generally conceded, however, that lithopedion formation in man is confined to extrauterine pregnancies in which part or all of the products of conception are extruded or initially implanted into the abdominal cavity, where calcification takes place.

The case of lithopedion reported in this article brings the total of authentic reported cases in the world's literature to 258. The lithopedion developed over an eleven-year period. The initial attack of acute abdominal pain was undoubtedly due to the rupture of an extrauterine pregnancy, with extrusion of the unattached fetus into the abdominal cavity, where it later became calcified. The subsequent periodic symptoms were due to recurrent attacks of pelvic inflammatory disease secondary to the initial process. Menstrual disturbances were secondary to functional cysts of the ovaries and to infection.

EDMUND LISSACK, M.D.

An Appraisal of Radical Pancreatoduodenectomy in the Treatment of Malignant Diseases. Gronqvist, Y. K. G., Ann. Chir. et Gynaec. Fenniae 44:120, 1955.

The author of this paper tries to estimate the value of radical pancreatoduodenectomy as an operation for cancer and concludes that the operation described by Waugh and Clagett in 1946 most nearly fulfills the principles to be considered in the choice of operations. From the anatomic standpoint, he points out, the close proximity of major blood vessels and the location of many regional lymph nodes in inaccessible areas make it very difficult to do an adequate cancer operation on the head of the pancreas. From the standpoint of pathology, he cites the studies of Miller and others, as well as statistics by Catell and by McDermott and Bartlett. From the standpoint of operability and resectability the author is apparently considerably discouraged and from the standpoint of the postoperative mortality rate, as cited by several published series, expresses the opinion about 10 per cent would be the expected figure.

The difference between lesions of the ampulla of Vater and head of the pancreas is once again brought out. With regard to postoperative morbidity, Gronqvist draws the conclusion that if the pancreatic juice from the remaining portion of pancreas is led into the intestines by some type of anastomosis and that if the patient has had a diet high in calories, protein and carbohydrates and low in fat, supplemented by administration of pancreatin, there is relief of discomfort, with no impairment of internal secretion by the pan-

creas. To follow up the results, he notes the data reported in various series, including that of McDermott and Bartlett, who compared 112 cases of carcinoma of the head of the pancreas observed during the period of 1931 to 1940 and 136 cases from 1941 to 1951, when resection for cure was in vogue. The percentage of survival by three month periods was calculated for all patients who left the hospital alive.

If one compares these percentage survival cures, it is apparent that, up to twenty-seven months, the curves are nearly identical. Beyond this point, all patients whose cancers had not been resected were dead, whereas 2 who underwent pancreatoduodenectomy were still alive.

The author concludes that, with this perspective for pancreatoduodenectomy in the treatment of cancer of the head of the pancreas, it is fair to say that 2 patients out of the entire group were benefited by resection. Discussing the follow-up results with regard to carcinoma of the ampulla of Vater, he cites the statement of McDermott and Bartlett that the average survival of patients with carcinoma of the ampulla has not been altered appreciably by the introduction of radical pancreatoduodenectomy. He cites also the astounding results reported by Cattell who has 15 patients still living and has reported that none in his series who survived four and one-half years or more had demonstrable metastases to the lymph nodes. Follow-up results on carcinoma of the common bile duct indicate a more favorable prognosis, as does also, probably, carcinoma of the second portion of the duodenum. In the author's opinion the literature tends to show that resection as compared with diversion of the biliary tract, is the superior palliative procedure for resectable lesions.

From all this he concludes that radical pancreatoduodenectomy in its present form is inadequate in the treatment of carcinoma of the head of the pancreas and should be modified or discarded. In his opinion, total pancreatectomy as advocated by Brunschwig offers an approach to the problem. Any resection for cancer that leaves behind the main venous and lymphatic channels draining the anatomic site of the origin of the cancer (In this case, the portal vein and its tributaries, and the lymphatics of the gastrohepatic ligament) will obviously fail except in a few cases. Further time will be necessary for evaluation of the operative procedure of Child and McDermott, which includes resection of the portal vein and the accompanying lymphatic system.

WARREN A. YEMM, M.D.

Twin Pregnancy and Delivery. Kurtz, G. R., Keating, W. J., and Loftus, J. B., Surg., Gynec. & Obst. 6:370, 1955.

This study was undertaken principally in an effort to probe into causes of the fetal wastage which so prominently characterizes twin pregnancy and delivery, and to elucidate the relation of certain controllable factors in twin delivery to twin survival.

With regard to operative deliveries, it was deemed advisable to ascertain the influence of the obstetrician on the outcome.

In this series of 500 consecutive twin pregnancies and deliveries it was observed that the main causes of fetal wastage in twin deliveries is prematurity and/or immaturity and increased liability of the premature twin to birth trauma and anoxia.

The birth hazard for the second twin is considered higher than that for the first twin.

There is no appreciable difference in weight between the twins.

Results may be improved by: (a) early diagnosis and better prenatal care; (b) elimination of unnecessary operative intervention and (c) reduction of the interval between delivery of the twins, particularly when small babies are involved.

The incidence of preeclampsia, hydramnios, and prolapsed cord is considerably greater than in single births. That of postpartum hemorrhage, however, is not necessarily greater.

There were no maternal deaths in this series.

EDMUND LISSACK, M.D.

A bill is the most extraordinary locomotive engine that the genius of man ever produced. It would keep on running, during the longest lifetime, without ever once stopping of its own accord.

—Dickens